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THE GEOLOGY OF LONG ISLAND WITH ESPECIAL REFERENCE TO THE COLD SPRING HARBOR REGION AND ITS FLORA.

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To the botanist Long Island* is of peculiar interest. It presents some unusually attractive features in the sea beach and sand dune flora of the southern coast, in the pine barren region vegetation of the central part of the island, in the natural prairie, (Hempstead Plain), in the lake vegetation of Lake Ronkonkema, in the deciduous forests of the great terminal moraines which run the length of the island on which are found a considerable variety of forest trees under special conditions; in the salt marshes, bogs and submerged gardens, all of the foregoing being easily accessible from the Biological Laboratory at Cold Spring Harbor. The value of the natural resources of Long Island is unusually great because of their proximity to a great consuming center, and detailed studies of its climate, soil, water supply, physiography and flora have therefore been made. On this account the relation of the vegetation to the physical conditions is more easily determinable, and the flora has been

* This account of the Geology of Long Island is based on the following publications: Fuller M. L. The Geology of Long Island, N. Y., U. S. Geol. Survey Prof. Paper 82, 1914; Veatch, A. C. and others, Underground Water Resources of Long Island, N. Y., U. S. Geol. Survey, Prof. Paper 44, 1906; Bowman, Isaiah, Forest Physiography, published by John Wiley and Sons; and the account of the Camp Mills quadrangle given on that topographic sheet by W. C. Alden.

** Accompanying map drawn by J. F. Mueller, Department of Zoology, University of Illinois.

made the basis of extensive contributions to botanical knowledge.

GEOGRAPHY AND GLACIAL TOPOGRAPHY*

Long Island belongs to the inner part of the Atlantic Coastal Plain. Its greatest length is 118 miles and its greatest width 23 miles. The south shore is double—the inner or primary shore line is the border of a broad *lagoon*,—Great South Bay and its extensions; the outer shore line consists of narrow sand *reefs* of remarkably regular outline enclosing shallow bays and salt marshes. Opportunity is given to observe this double shore line in the annual excursion of the Laboratory to the south shore, Great South Bay being about one hour's drive by automobile from the Laboratory. The north shore is without notable indentation, but the western half is deeply embayed by a dozen or more well developed *fjords* such as Cold Spring Harbor, with steep sides and noteworthy depth of water. Here the fjord is five miles long and hardly a mile wide opening into Long Island Sound, itself an inland sea.** The vegetation of these harbors is well typified by that at Cold Spring Harbor, which has been made the subject of extensive study by Transeau ('13) Johnson, York and Conard ('15), Conard ('24).

The profile section of Long Island north to south as one approaches the shore, indicates first a high plateau going inland. After a number of miles there arises abruptly to

* Topographic maps of the U. S. Geological Survey dealing with the immediate region of Cold Spring Harbor are those of the Oyster Bay and Northport quadrangles. Others dealing with Long Island are those of Staten Island, Brooklyn, Hempstead, Babylon, Fire Island, Sag Harbor, Easthampton and Montauk quadrangles on the southern shore; the Harlem, Setauket, Moriches, Riverhead, Shelter Island, Gardiner's island on the north shore. Geological Folios have been issued for the Staten Island, Harlem and Brooklyn quadrangles. The prices of the maps are \$.10 each when obtained from the Survey, but they may also be obtained from Abercrombie and Fitch, 57 Reade St., N. Y., or at Rand, McNally Co., 42 E. 22nd St., at a slightly advanced price.

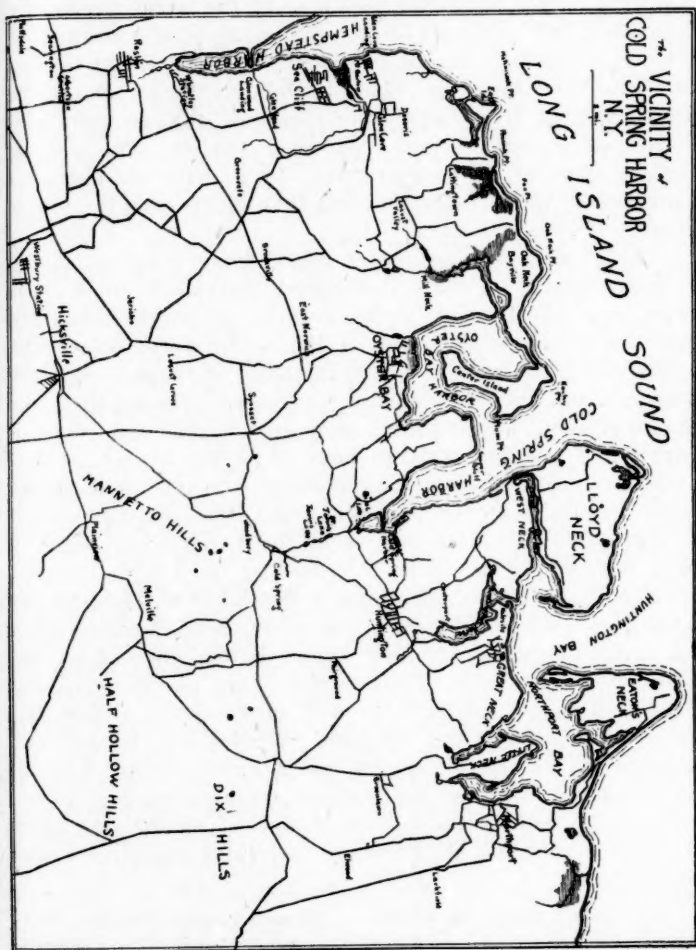
**The results of a Biological Survey of the waters of Long Island Sound by Dr. P. S. Galtsoff are in preparation and will be published by the U. S. Bureau of Fisheries.

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a height of 100-150 ft. a high ridge composed of stratified materials. This is termed the Harbor Hill *moraine*, and it attains a height of 391 ft. above sea level, one and one-half



miles east of Cold Spring Harbor. Sloping to the south is the outwash formation. After a few miles south of irregularities, low ridges and mounds, another moraine is encountered—the

Ronkonkema—which is 410 ft. above the sea at High Hill, Huntington. It is considered to be the older of the two, since at places it is buried beneath the first. These two conspicuous morainal ridges form the backbone of the areas previously indicated, and each is a direct continuation of moraines of Wisconsin age which are traceable from the Rocky Mountains to New Jersey to Long Island, Nantucket and Cape Cod. East of Huntington, the moraines diverge more and more and enclose broad, sub level tracts. The coastal region, however, is comparatively level, with an elevation above sea level ranging from less than 50 ft. over the greater part of Long Island.

The glaciers invaded Long Island more than twice, for certain deposits of clay and gravel and sand show that there were advances of the ice even before the Ronkonkema moraine was formed. Most of the material composing the bluffs along the north shore and inlets is thought to have been laid down by this earlier ice sheet.* The eastern terminus of each moraine gives character to that end of Long Island and encloses a large body of water known as Peconic Bay. The Ronkonkema moraine is remarkable for the large body of water it encloses, Lake Ronkonkema, visited yearly by the botanical classes at the Laboratory. This is in a former glacial *kettle hole*, and is by far the largest lake on Long Island, attaining a depth of 80 ft., and extending to about 25 ft. below sea level. Both moraines bear the usual marks of terminal accumulations formed by the *continental ice sheet*. Their surfaces are deeply pitted by large and small kettle holes and depressions. Upon the floors of some of the enclosed depressions lakelets or swamps occur, and all others are distinctly moist, but by far the larger number are without standing water. Large portions of both moraines are composed of till of rather typical composition, but there are extensive localities where

* Dr. Ernest Antevs in a letter to the writer dated March 5, 1925, reports the finding of varied clay (the summer and winter deposits of glacial waters) at Glen Head, L. I., a few miles east of Great Neck, at a brick yard one-half mile east of the station. He adds that varves, (each of which represents one year of the glacial retreat), may be expected here and there on the northern coast as exposed.

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sand may compose all or nearly all of it. The sandy phases are developed chiefly at the eastern end, the clayey phases at the western end of the island. Boulders, large and small are scattered freely upon the surface and throughout the mass of both moraines. They are of variable composition—gneiss, schists, sandstones and quartzites predominating.

The long, gently sloping *outwash plains* extending southward from the moraines have been mentioned. Their northern margins are in many places pitted by kettle holes. Examples of these kettle plains are found west of Cold Spring Harbor station at Syosset and southwest of Huntington at the fair grounds. Where kettle holes have permanently obtained a water supply they have frequently influenced the settlement of the island. Two papers by Conard ('13-'23) deal with the revegetation of an area near Syosset which had become denuded artificially, and his observations yield clues as to the method of the first occupation of these outwash plains by the post glacial flora of Long Island.

The porous nature of the outwash material greatly reduces the run off of precipitation and instead of a normal run off of about 30%, such is only about 20% of the normal. The reduced run off has retarded the dissection of the frontal plains and the small elevation has favored the same result. There extend mile after mile of almost flat plains of alluvium in striking contrast to the ruggedness and picturesqueness of the terminal moraine. Plenty of old channels mark the beds of former streams, but few streams flow in them. The present drainage consists chiefly of small, wet weather streams extremely diminutive as compared with the ancestral streams whose channels they occupy. Veatch ('06) has shown that the effect of dams on the brooks of Long Island is to very materially decrease the stream flow at the points where dams are erected, and keeping in mind the foregoing, it may be deduced that a large amount of water escapes through the porous sides of the pond. Illustrative of the effect of this condition on vegetation of Long Island is Harper's account of a Long Island cedar swamp ('07). This swamp is located at Merrick, near the south shore of the island.

Excavations on the plain expose waterworn gravel and

sand and the evidence is that it originally was a natural *prairie* in the midst of a generally wooded region. The south plain is somewhat more extensive than the north plain, (which is between the two moraines), and ranges in width from less than a mile to more than 10 miles. A large tract of the surface of the south plain in the vicinity of Mineola, Hempstead and Camp Mills has always been open prairie, but elsewhere both the north and south plains were once covered with scrub oaks, scattered pines and underbrush and the terms "brushy plain" and "pine plain" which were in early days used to distinguish parts of them from the Hempstead plains, are still widely applicable. In North Hempstead the south plain stands 120 ft. above sea level, but north of Hicksville it rises to 200 ft. It is not much cut by sharp ravines or valleys, but is traversed from north to south by a series of channels 10-20 ft. deep, in the bottom of which springs issue and feed small streams that flow through the southern third of the plain, finally discharging into the marsh bordered channels at the south shore. Harper ('12, '18) has made a valuable study of the vegetation of this natural prairie, relating it to the geological conditions indicated. The prairie is within 5 miles of Cold Spring Harbor. Hicks (1892) first comprehensively listed the plants from this region.

The valleys of Long Island are generally free from conspicuous branching as would be expected if produced by the ordinary process of stream erosion. On the borders of each main valley are many smaller later valleys sloping toward the harbors, and more or less filled with late *drift*. Some of the original valleys of Long Island are buried, and were formed by glacial waters as well as by existing streams. The valleys in the Manhasset formation (Pleistocene) are everywhere conspicuous, having been cut from an elevation of 200 ft. Most have become modified from the action of the ice or the deposition of glacial debris. In many the modifications are confined to the deposition of a superficial mantle of drift. There may be low morainal accumulations on the valley sides such as that at Cold Spring Harbor. The slope of the bottoms of the valleys is usually gentle, 10-15 feet per mile, and they flatten in the lower mile or two per-

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mitting these parts to be occupied by the estuaries of the sea, and causing a slackening of the drainage. Such is the condition at Cold Spring Harbor. (Johnson and York, Conard, *loc. cit.*)

"Cold Spring Harbor,* which extends back in the Country for 3 miles from the upper end of the harbor, is a sunken river valley. In the valley runs the stream of Cold Spring Creek, which expands at three different levels into broad, deep and shallow ponds connected by waterfalls and shaded by dense foliage. Cold Spring Creek, flowing laden with silt into the upper end of the harbor has aided the sea in forming the *sandspit* which nearly cuts off an inner basin having an area of 110 acres at high water and 45 acres at low water, the mean range of the tide being 7.75 ft. and the maximum depth being 7 ft. over an area 100 ft. in diameter. The inner harbor is silting up, and its water is decidedly brackish at high tide varying from 1.006 to 1.016 at the surface and from 1.006 to 1.018 at the bottom.

The passage from the inner basin to the harbor is only 200-300 ft. wide at low tide, and through this gut the water flows at times with great rapidity. The steep sides of the harbor are piles of glacial drift full of clay, siliceous sand and gravel and boulders of varying size. This determines the prevailing character of the shore line, sandy or gravelly beaches with boulders extending into deep water and most abundant at the base of the worn off bluffs. Mud flats are common, but for the most part are underlaid with sands at a depth of 1-3 ft. A mud flat extends from parts of the sandspit at the level of mean low tide. No rock occurs in place, but on many headlands the accumulated boulders form an extensive rock work. At intervals the shore line is diversified by salt meadows, partly enclosed salt ponds and shallow harbors and bays.

Opening into Cold Spring Harbor at about the middle of its western side is Oyster Bay, a tortuous body of water running back some 6-7 miles and having a breadth varying from $1\frac{1}{2}$ miles to $\frac{1}{2}$ mile. Oyster Bay also receives at its

* Following the account of Davenport, C. B., and Johnson, D. S. The Flora about Cold Spring Harbor ('98).

upper end a fresh water stream, Mill Creek, which is of considerable volume, while both harbors receive at intervals along their coast line smaller streams. In the outer harbor above the entrance to Oyster Bay the water is uniformly 15-18 feet deep at low tide. Immediately below Oyster Bay entrance is a bar with only 6-10 ft. of water at low tide. At the eastern end of this bar is a channel 72 ft. deep. Outside of the bar the water deepens steadily toward the middle of the sound."

The flora of the outer coast of the north side of the island, of the quiet mud bottomed pools a hundred yards back from the outer beach which are flooded at high water by salt creeks, of the boulders scattered along the shores of the harbor, of the quiet brackish areas near its inner end, of the lakes at the upper end of the valley, of the springs and pools on the edges of these lakes and the dense woods surrounding them forms the basis of this list, to which have been added the plants encountered on the excursions of the botanical classes.

Observations indicate that about four-fifths of the ordinary shallow valleys lying south of the outer moraine have steeper banks on the west than on the east side. A study by the writer ('23) indicates that the cumulative effects of wind and vegetation upon wind borne materials may explain this in part at least. Exceptions appear, however, in the deepest valleys. Here the configuration depends on the curvature of the streams. The erosion and cutting continue unto the present day on the south shore where the water table comes to the surface and supplies short streams with water. The side slopes of the valleys are in large part steep and wooded and are not now undergoing rapid change but storm waters cut ravines in them, and springs here and there form gullies and cause loose sand to flow out as quick sand.

The south coast originally consisted of broad, lobelike projections of sand and gravel since extended by the formation of marsh deposits. Some believe these lobes were formed by the deposition of materials carried out by the melting ice, and that the southern two-thirds of the island is thought to be made up of confluvial deltas from glacial

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streams; others that the sands and gravels of the south side represent the underlying Tertiary formations.

Taylor, ('15), remarks that "the glaciated portions of our range, besides being the home of so many native plants not found elsewhere is typified by the large percentage of hardwood trees, the relative scarcity, numerically of coniferous trees and above all by the great number of species introduced. Perhaps three fourths of all adventive and naturalized species find their greatest development in this area. The glaciated portion (Long Island) contains many swamps, ponds and bogs and it is the latter that are the chief interest to the botanist. These undrained areas maintain a flora quite characteristic. It has been shown that that section . . . which was neither glaciated nor on the coastal plain does not contain these plants, characteristic of the glacial bogs of the north and also found in the typical cranberry bogs of the coastal plain." Swamps, ponds and bogs are readily accessible to the botanist in the immediate vicinity of the Laboratory at Cold Spring Harbor, and the region of Lake Ronkonkoma, while the classes make excursions to the nearby bog at Woodbury. A popular article in this connection is by Vail ('95) dealing with the June flora of a Long Island swamp.

Taylor ('15) also gives a list of ferns, fern allies and seed plants found only north or south of the moraine. Additions to the Flora of Long Island north of the moraine but not necessarily limited to that region are found in recent papers by the writer, ('24-'25). Little if any work has been done in this connection upon cryptogamic groups. Harper, (1917a,b.) has described the conditions of vegetation in the glaciated and unglaciated portions of Kings and Queens Counties in the western part of Long Island, bringing out interesting differences.

Taylor, ('15) additionally points out "Long Island is geographically unique in that the terminal moraine abuts directly on the coastal plain for nearly the whole length of the island. Whether as previously indicated the region south of the moraine is mostly overlaid with overwash material from the glacier or whether the sands or gravels of the south sides are the underlying Tertiary formations, may be

a matter of doubt. It would make an interesting future study to determine the effect if any of the distribution of these different sands and gravels on the distribution of the plants on the island."

Associated with Tertiary soils and the coastal plain are the Pine Barrens of Long Island which have been described in part by Britton ('80), Harper ('08) and for Staten Island by Burnham ('13).

RECENT EPOCH

During post glacial times transportation has taken place on a large scale; the waves cutting into the bluffs at Montauk Point and at some places farther west, have sorted out a vast amount of sand which has been transported southwestward in the direction of the prevailing winds, and has been built into *bars*, crossing the narrower inlets and into notable *barrier beaches* such as Fire Island and Rockaway beaches, and across wider bays. Storm waves sometimes cut channels through these barriers, and some of the channels are kept open by the tidal flow, the outflow from enclosed bays. The surfaces of these beaches are in many places diversified by hillocks of wind blown sand or *dunes* 10-30 ft. in height. The growth of vegetation in the shallow waters behind the barrier beaches has produced a great marsh which is intersected by a bewildering maze of channels and small bars. These deltas, beaches, bars, dunes, and the sandspits, marshes and connecting beaches to be mentioned constitute the recent series of deposits and as will be seen, are in the process of formation today. The vegetation of the region of Montauk has been extensively studied by Taylor ('23) and in less detail by Clute, ('97-'99).

When the ice retreated there were many disconnected islets adjoining the mainland. In most places the intervening waters were shallow. The waves and shore currents rapidly extended hooks and spits completing Long Island as it now appears. Marshes and beaches served as connecting agencies in the cases of Oak Neck and Center Island, while Lloyd and Eaton Necks are connected by beaches alone. Such beaches are thought to have joined with Long Island what must have been 15 distinct islands. Studies

of interest indicating the nature of the process, i. e., marsh formation during recent years are those of Johnson, York, and Conard, *loc. cit.* Harshberger ('07-'16) has also made marked contributions to our knowledge of the vegetation of these salt marshes.

The bluffs of the open northern coast are mostly free from vegetable growth. The remainder are artificially covered with grasses, trees and other vegetation as at Cooper's Bluff. The whole line of the coast may be changed by a single storm which may eat into the bluffs, or throw up in front barriers of sand gravel according to the direction of the wind, angle of impact of the waves and nature of the currents set up. As the larger stones that slide down the bluff are moved but little if at all by the waves, they accumulate in some places and there protect the shore. The barriers stay until removed by storms and currents in other directions. Some last for years on account of grasses and trees taking possession of them, but sooner or later cutting begins again. The cliffs are best preserved where coherent materials exist in them. Good exposures of their component structures are found at Eaton and Lloyd necks. In the regions where they are destroyed there ensue lesser bars, beaches and spits connecting smaller islets with the mainland or projecting into harbors, (such as the sand spit at Cold Spring Harbor), the bays or the sound. Generally, the current flowing out of the inlet is strong enough to keep a narrow channel open, but the waves form a hook at the tip of the spit. The prevailing direction of the wind on the north shore is westerly, but the direction changes frequently, when under certain conditions spits may be extended from both sides of a point or inlet. Such processes have largely made the shore of Long Island more regular. A detailed account of the formation of the sandspit at Cold Spring Harbor and its animal ecology has been given by Davenport, ('03), while the plant ecology has been studied by Johnson, York and Conard (*loc. cit.*)

Long Island thus appears to have been the result of the opposed agencies of deposition and erosion. It is comparatively small now, for since Cretaceous times erosion has predominated over deposition. It is estimated that the amount

to be removed before the island is reduced to sea level is less than that removed in the past. The present form of the island appears to be due to constructive rather than destructive agencies. Since the disappearance of the ice sheet there has been some subsidence of the island—about 25 ft. Some think, however, this subsidence may indicate only the washing through of the lower beaches, or even local submergence. The studies of Johnson, York, and Conard, ('15) and Conard ('24) afford a quantitative basis for the further study on Long Island of this question from the botanical side.

TOPOGRAPHIC FEATURES RELATED TO STRUCTURE AND GEOLOGICAL HISTORY*

The basal deposits of Long Island consist chiefly of pre-cambrian gneiss with intrusions of granite, dolomite and gneiss, the latter appearing as ledges on the banks of the East River.** Upon a base-levelled and down warped rock floor, Cretaceous and Tertiary materials were laid down, the line between the deposits of the coastal plain and the metamorphic rocks crossing the extreme west end near Long Island city. The Cretaceous deposits correspond to beds of similar age in New Jersey and southwards. They have not been seen however, in the western half of the island nor have positive equivalents of the Tertiary deposits of the mainland been noted. Only a part of the deposits are true coastal plain deposits, the greater portion of the underlying surface being material of Pleistocene age representing the morainal and outwash accumulations associated with continental glaciers. The Cretaceous is highly developed and possibly comes to the surface at High Hill at Huntington.

* The account given by Hollick ('93) is followed here.

** Among the minerals found on the beach of the sandspit at Cold Spring Harbor are red sandstones and shales evidently from the Connecticut Valley lowland, arkose sandstone, quartzite; grey quartzite, quartz schist (slate schist), granite, mica schist, granite gneiss, quartz (rosy, smoky, yellow), conglomerate. Cretaceous clays at Cold Spring Harbor also yield pyrite, limonite and lime concretions.

For the collection of these minerals I am indebted to Miss Betty Watt, University of Pittsburgh, for their identification to Professor J. W. Goldthwaite of Dartmouth College.

Two outcrops of Cretaceous materials occur on the west side of Cold Spring Harbor, one one-half mile south of Cooper's Bluff, the other opposite the village, one-half mile northwest of the sandbar. Above are the Wisconsin stage deposits consisting of till, stratified gravel, and also white sand, yellow, white and salmon colored clays. On the east side of the harbor are abandoned clay pits, south of Lloyd Beach which connects Lloyd and West Necks. Here occur diatomaceous deposits, and Cretaceous plant fossils, (see list), indicating a past land connection with New England. Our knowledge of the fossil flora of Long Island is mostly due to the researches of Hollick ('93-'12) with Newberry ('86) Ries, ('84) and Jeffrey ('06-'08) adding important contributions.

Following the laying down of Cretaceous and Tertiary materials, (clays, sands, gravels and marls), along the eastern borders of the north American continent an era of elevation began, which raised them hundreds of feet above their present level, forming a wide coastal plain which extended into what is now a part of the bed of the Atlantic Ocean, probably at the 100 fathom contour. It is thought to have been bounded on the land side by the crystalline and Triassic rocks of Connecticut, southern New York and Pennsylvania. There is reason to believe that its limits were approximately that of the coast line today. This area will be seen to include the whole of Staten Island, Long Island, Block Island, Martha's Vineyard and Nantucket besides a large portion of the submerged coast, eastward and southward.

The ensuing erosion was first normal, and resulted in the formation of an inner lowland where Long Island Sound occurs. The erosion of this inner lowland was continued to the point where a well developed *cuesta* was formed and it is to the further accumulation of glacial materials upon the summit of the *cuesta* that Long Island owes its present marked contrast between rugged moraine and abrupt high shores on the one hand and smooth southern plain, with low reedy, flat southern shores on the other. The scouring action of the ice sheet further deepened the inner lowland and with the final disappearance of the ice sheet from the

region a slight sinking of the land brought out even more strongly the features owing to depression. It seems probable that at some time during the oscillations of level, that the sea having eaten away the coastal plain, finally reached the barrier of the terminal moraine. The moraine gave away in places, channels were formed and detached portions remained to form islands recognized today as Block Island, Martha's Vineyard, Nantucket and the many lesser islands streaming from the end of Long Island toward Cape Cod, while the eroded portions are represented by the great submerged ridges known as the Nantucket or other shoals.

SOILS AND VEGETATION

"Soil maps of Long Island show four broadly defined types of soils: (1) stony loams and gravels which occupy the terminal moraine and the narrow plateau between the northernmost moraine and the north shore as in the vicinity of Cold Spring Harbor; (2) coarse sandy loams which constitute the greater portion of the outwash plains; (3) fine sandy loams which form the outer fringe of the outwash plains and those portions of it adjacent to the old drainage ways; (4) clay loams that form a transition type between the upland and the salt marsh and the beach sands. While the clay loams have greater natural fertility than the sandy loams they are often found on lands too rough for cultivation and the great market gardens are found on the outwash plains principally where many of the conditions are ideal.

Of the soil types apt to be encountered in the area covered by the accompanying list of plants there is first the Alton stony loam which is found in the immediate vicinity of Cold Spring Harbor. "A large portion of the Alton stony loam was formerly predominantly forested with chestnut and a characteristic undergrowth of mountain laurel, the moraine particularly, bearing scarlet and red oak, some white oak, hickory, chestnut, and in a few localities scattered pitch pines. Dogwood forms a notable undergrowth with masses of fern

* For a detailed discussion of the soils of Long Island see Soil Survey of the Long Island Area, N. Y. Bonsteel, J. A. and party, U. S. Dept. of Agriculture. Bureau of Soils, 1903.

and considerable greenbrier among minor plants. Unoccupied fields grow up to cedar. The locust thrives on this soil, and is cared for to form a supply of fencing material. In the more western area of the island market garden crops are produced from this soil, and it is well adapted to the later truck crops." The village of Bayville is built upon the Alton stony loam.

The Galveston sand composes the sandspit at Cold Spring Harbor, is found also at Cooper's Bluff, and forms the sand dunes of the ocean shore,, where it becomes covered with wiry grass, cedars, and oaks. It has no value as an agricultural soil. With the Galveston sandy loam it makes up the beaches of the south side of the island, and connects most of Center Island with the mainland. The Galveston clay forms the banks of Cold Spring Creek near the Laboratory. It is constantly saturated with tide water.

At the top of the hill on the east side of the inner harbor one encounters the Miami stony loam. It was originally strewn with large sized erratic glacial boulders, and is a typical glacial soil. Its texture and structure place it in the group of grass and grain producing soils. It is the most drought resisting type found on Long Island and produces good yields of later truck crops, but the majority of the crops are produced by the fertilizer rather than the inherent fertility of the soil. This soil also occurs at Lloyd and West Necks, and covers most of Center Island.

East of Cold Spring Station and in the vicinity of the fairgrounds at Huntington is the Hempstead loam. It is the chief soil of the Hempstead Plain. It is however underlaid at a depth of about 2 ft. by a bed of rounded quartz gravel—"hard pan"—which is a determining factor in the vegetation of the plain. The Hempstead gravelley loam occurs around the margins of the Hempstead loam, and in the narrow dry stream beds of the plain.

The Norfolk sand occurs in the pine and scrub oak country, north of Lake Ronkonkema and the country just north of Babylon, Bayshore and Islip. It is the typical pine barrens soil, and is too much subject to drought to be of value for cultivation. The distribution of stunted species of oaks on certain sections of the moraine corresponds almost pre-

cisely with that of the Norfolk sand. South of High Hill at Huntington occurs the Norfolk gravel. It is referred to earliest Pleistocene deposition. Agriculturally, it is useless. Southeast of Cold Spring Station is a small patch of the Sas-safras gravelly loam. It is well drained, and is intensively cultivated for garden crops. This type also occurs at St. James, Long Island.

CLIMATE*

This is maritime in type. The tempering influence of the Atlantic Ocean is modified to a considerable extent by the prevailing westerly winds from the continental interior, giving the region relatively mild winters for the latitude and not excessively warm summers, long growing season and abundance of precipitation well distributed throughout the year, and rather high relative humidity. On Long Island the driest month is April with a total of 7.3% of the total annual precipitation while the wettest is August with 10.5%. The winter rainfall is generally greater than that of spring or autumn, and only 3% less than of summer. The average length of the growing season between the last killing frost of spring and the frost of the fall is something over 200 days for Long Island. For the benefit of botanists desiring the use of the facilities of the Laboratory throughout the year the following records compiled from those of the U. S. Weather Bureau are cited.

The means of the records of the monthly, annual and average amount of precipitation in inches of the two nearest weather stations to Cold Spring Harbor are:

STATIONS		Elev.	No. yrs.	Jan.	Feb.	Mar.
Oyster Bay-----	50 ft.	12	3.88	2.39	3.72	
	Apr.	May	June	July	Aug.	
	4.09	3.48	3.61	4.26	6.68	
	Sept.	Oct	Nov.	Dec.	Annual	
	4.3	3.68	2.53	3.47	46.09	

* Compiled from reprint of section 104. Eastern New York Summary of Climatological data for the United States by sections, U. S. Dept. of Agriculture, Weather Bureau.

Roslyn-----	Elev.	No. yrs.	Jan.	Feb.	Mar.
	220 ft.	9	4.17	3.62	4.31
	Apr.	May	June	July	Aug.
	3.78	3.70	3.55	3.73	4.59
	Sept.	Oct	Nov.	Dec.	Annual
	3.78	3.43	2.82	4.57	46.05

Setauket-----	Elev.	No. yrs.	Jan.	Feb.	Mar.
	40 ft.	35	4.	3.98	4.29
	Apr.	May	June	July	Aug.
	3.74	3.44	2.73	4.17	4.31
	Sept.	Oct	Nov.	Dec.	Annual
	3.50	4.12	3.66	4.03	45.97

The principal temperature records are from Setauket where the station is located on a neck of land that projects into the estuaries of Long Island Sound, ground level, and nearly surrounded by water.

TEMPERATURES AT SETAUKET

	Jan.	Feb.	Mar.	Apr.	May	June	July
Mean (35 yrs.)-----	30.8	29.5	37.1	47.3	57.9	66.2	72
Highest temp. (31 yrs.)--	66	64.	75	87	91	93	98
Lowest temp. (31 yrs.)--	-3	-6	7	21	34	40	50
	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
Mean (35 yrs.)-----	70.6	64.8	55	44.3	34.6	50.8	
Highest temp. (31 yrs.)--	95	93	86	71	63	98	
Lowest temp. (31 yrs.)--	50	37	31	16	-7	-7	

For Setauket, in 31 years, the earliest date of the last killing frost in the spring is given as March 27 with the latest May 17. The average date, however, is found between the second and third week of April. In the fall, the date of the earliest killing frost is Oct. 22nd, the latest November 29, the average occurring in the first and second weeks of November. For this same point the greatest growing season recorded has been 247 days, the minimum 158 days, with an average of 211 days.

THE FLORA OF COLD SPRING HARBOR AND BOTANICAL RESEARCH

Opportunities for the systematic botanist are indicated at least in the paucity of records for certain plant groups in the accompanying list, especially the cryptogams. The records to date include the following main divisions of the plant kingdom, exclusive of the Bacteria, and to this list may be added the records of Jelliffe ('99-'04) Burnham and Latham ('14-'24) Fish ('25), Bigelow ('22).

GROUP	GENERA	SPECIES
Schizophyceae	20	47
Myxomycetes	26	57
Flagellatae	7	9
Dinoflagellatae	6	14
Silicoflagellatae	2	2
Diatoms	44	75
Conjugatae	18	59
Chlorophyceae	32	51
Charophyta	2	5
Phaeophyceae	22	33
Rhodophyceae	37	54
Phycomycetes	9	9
Ascomycetes	37	53
Basidiomycetes	82	185
Fungi Imperfecti	16	20
Lichenes	15	32
Hepaticae	22	38
Musci	43	63
Filicales	21	32
Equisetales	1	1
Lycopodiales	2	5
Isoetales	1	1
Gymnospermae	9	13
Monocotyledonae	106	234
Dictyyledonae	412	773
Totals	991	1,865

Protozoologists have remarked upon the unusual richness of the Flagellate flora of the Cold Spring region, but this has received little attention so far. The American forms should be more comprehensively studied, following the lead of Walton ('15). Additional records for the Dinoflagellates,

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Silecoflagellates and Diatoms may be expected in the forthcoming report of the Biological Survey of Long Island Sound conducted by Dr. P. D. Galtsoff under the direction of the U. S. Bureau of Fisheries. Material in the possession of Professor Transeau will undoubtedly yield new records for the Conjugatae and Chlorophyceae. Many exotic species of ferns and seed plants are represented in the gardens of estates in the vicinity of Cold Spring Harbor. The estates have generally been available to members of the Laboratory, and their flora will be the subject of a later list by the writer. Botanists will be able to collect abundant material for classroom use in the vicinity of the Laboratory, while the range of the flora may prove suggestive to the plant anatomist. Of especial interest to the latter are the fossil plants of Long Island, the structure of some species of which have been studied by Hollick and Jeffrey ('09) but many have not received such attention.

The account given of the relation of the geology of Long Island to the flora, so far as it has been studied, may be of interest to the plant ecologist. As suggested by Conard ('24) it is hoped that observers may be found to study the succession of the vegetation in subsequent years in the salt marsh and sandspit. Investigations of the salinity of the water in the various creeks and rivers flowing into Cold Spring Harbor, and the rate of evaporation at different levels above and below high water marks await plant physiologists, to whom the flora of the salt marshes, especially those plants which are exposed to both fresh and salt water are of peculiar interest. Opportunities for the plant geneticist are at present mostly limited to collaboration with members of the staff of the Carnegie Institution.

The adjacent library of the Department of Genetics, Carnegie Institution of Washington, the easy accessibility of the New York Botanical Garden, the Brooklyn Botanic Garden, the American Museum of Natural History in New York City, and the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., in addition to the above make the Biological Laboratory at Cold Spring Harbor, N. Y., a convenient center for botanical research the year around within of course the limits of the type of investigation to be pro-

jected. The increased facilities now being planned by the Board of Directors will make it even more so.

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THE RELATIONS OF VEGETATION TO BIRD LIFE
IN TEXAS.

HARRY C. OBERHOLSER.

INTRODUCTORY.

The present paper was originally intended as a part of the author's still unpublished treatise on the birds of Texas. It has, however, outgrown its place in the introduction of that report. The data set forth in the following pages were gathered by the various naturalists of the Biological Survey in the course of many years of zoological exploration in all parts of Texas. No one more than the writer regrets the limitations of treatment, which are for various reasons necessary. We have tried, however, with the information at our disposal, to prepare an outline of the ecological areas in various parts of this State, leaving the details to be gathered by future investigators. Since the probabilities of our returning to this field are slight, it seems worth while, with this explanation, to place on record what information we now possess.

A word should be added concerning our use here of the term "association." The groupings of associations are intended to be largely geographic, and therefore small associations, even though strictly ecological, have in many instances been included in the larger areas. In such cases our "associations" are technically equivalent to "formations," but since we give characteristics of each area, it will be easy for the reader to ascertain which are strictly associations and which belong to the more inclusive category.

The writer is indebted to Mr. Paul C. Standley, of the United States National Museum, for the verification of all plant names in this paper and to Dr. H. H. T. Jackson for a number of helpful suggestions.

RELATIONS OF VEGETATION TO BIRD LIFE.

All animal life is either directly or indirectly dependent on vegetation for its existence. The more direct this dependence the more obvious, of course, is the relationship. This relationship may be expressed in terms of either physiological or of physiological ecology. It is evident from even a superficial study that vegetation, other things being equal, is one of the most potent influences in the distribution of birds, upon whatever the distribution of vegetation itself may depend. Thus vegetation, aside from its direct influence in providing food and suitable environment, has indirect influence through hindering or facilitating the presence of enemies, and in many ways affecting the supply and distribution of moisture. We must look, therefore, in explanation of the peculiar distribution of certain birds, to the often concomitant differences in vegetation. What is, in this way, true in Texas, is doubtless so in other regions. The influence of vegetation on bird life is, however, probably not so fundamental as either temperature or humidity, because these, in addition to their direct effect upon the bird, determine also directly the presence, distribution, and character of vegetation itself.

That this relationship between vegetation and bird life is of great importance from an economic as well as from a purely scientific standpoint is indisputable. It must be taken into account in all questions of the introduction of species, since certain birds will not thrive unless the environment of vegetation is suited to their needs; and an attempt such as the introduction of a strictly forest bird into an arid desert is, of course, futile. In attracting birds to our homes, if the attempt is to be at all permanently satisfactory, due regard must be had to the planting of suitable trees and shrubs, for in both a natural state as well as under artificial conditions it is perfectly evident that vegetation has direct and important bearing on the protection and even the very preservation of bird life.

Vegetation influences bird life and its distribution in several ways. Its effect on the food supply is probably to be regarded as most important, since all animals, including in-

sects, must be nourished by vegetation or by other animals that feed on vegetation. In this connection should be emphasized the important part borne by insects in the economy of birds. Most insects feed directly on vegetation, all at least indirectly; and since birds to a great extent eat insects, they are thus indirectly dependent on vegetation for this part of their diet. Seeds furnish by far the greater part of the nourishment derived by birds directly from plants, since they contain highly concentrated nutritive elements. Other portions of plants, however, principally the leaves, and in many cases bulbous roots, are important articles of diet. An abundance of plant food naturally attracts birds; a paucity repels them; for while some birds are able to sustain life and strength for comparatively long periods without food, and often live in places where food is scarce and hard to obtain, yet most birds require large quantities of nutriment at frequent intervals, making necessary a living area which permits ready access to a bountiful food supply.

Next to food, probably suitable nesting places constitute the most important elological factor in a bird's existence, since without proper places for rearing its young the species would soon become extinct. The disastrous effects of the destruction of nesting places, or the prevention, from any cause, of access by the birds to their accustomed breeding places, has many times been exemplified. Birds that build nests in trees, or bushes, or on the ground among the grass, are most dependent upon vegetation. The matter of nesting, however, is not, as is the case with food, dependent fully on plants, since many kinds of nesting sites are admirably suited to the needs of birds, although without the direct assistance of any kind of vegetation. Man can often very materially assist the birds by providing suitable nesting places.

Suitable shelter, aside from that required for reproduction, is also an important factor in the well-being of bird life. This may readily be shown by a mere recital of the great destruction that occasionally takes place when birds are caught without shelter in storms at sea; in blizzards on the prairie; or are overtaken by any similar catastrophes. Here too, as in the case of nesting sites, vegetation is not responsible for all, but exercises, nevertheless, a very im-

portant influence. The cover afforded by forests, thickets, marshes, swamps, heavy grass, and the cavities in the branches or trunks of trees, are good examples of the shelter with which vegetation provides the birds.

Also by providing habitats suited to the various species, vegetation affects the welfare of birds, though probably in less degree than in the other ways already mentioned. It is well known that birds having food, proper nesting places, and shelter still evince a preference for certain kinds of habitats. Birds often consistently prefer particular locations over others that are apparently just as desirable; as, for instance, the case of the purple martin, which appropriates a certain nesting box year after year, and just as persistently refuses others only a short distance away. Of course, suitable habitats are to a considerable degree often made so by the fact that they furnish food, nesting places, or shelter, but, doubtless, in addition to all these there is in most cases the added consideration of purely individual preference on the part of the bird. This applies as well to winter homes as to those of summer.

METHOD OF TREATMENT.

Our purpose now is to show the very intimate relation of the bird life of Texas to its environment of vegetation. The following scheme of ecological distribution is intended to show, in so far as *Texas* is concerned, the relative associations of birds and the difference in the avifauna of the various areas in the State. Owing to the limits of the present treatise this has not in most cases been carried to its greatest possible refinement, but is intended to show in a somewhat *general* way what birds and plants are to be found in given environments; hence *nearly all of the areas given are capable of further subdivision*. We have for this purpose divided Texas into its most salient physiographic sections, and these, it should be noted, have no *necessary* correlation with the faunal areas and life zones of the state. These sections we have further divided into their most important vegetation areas. The resulting ecological associations are here treated with regard to their relations to each

other, and particularly with regard to the ecological relations of their *birds* and *plants*. It is apparent that many of these ecological associations correspond very closely in general character of vegetation to others in different physiographic sections of the State, and in these cases the differences in flora and fauna are evidently due to temperature, humidity, and similar concomitant influences.

The plant lists for the various areas are, of course, only partial, but are intended to give an idea of the botanical facies of each; and, together with the lists of birds, to show what combinations of plants and birds are found associated. For lack of conclusive data, no distinction is here made between plants that are *characteristic* of a single association and those that occur in several. Species of very rare occurrence are marked (R). Comparison of these lists will show, therefore, upon what combination of plants any given combination of bird is dependent. A few areas that are practically without vegetation are included, to exhibit the resultant paucity or bird life. Material change in the vegetation of an area will be followed by a corresponding change in the avifauna; and a complete transformation of the plants of one association into that of another will bring about a like transformation in the bird life.

One or two points it may be well to note with regard to the general distribution of birds in this region. Wide ranging species like hawks, vultures, some shore birds, and a few others, occur in practically any environment, and but few of all the birds of the State are confined to any single ecological association. The result then is, as in plants, sets of species made of partly the same species with the loss of some and the presence of some others as compared with any other given area. The proximity of two greatly differing plant areas has often a marked effect on the avifauna of both. For example, a marsh furnishes nesting places for many species that feed along an adjoining beach or in cultivated areas, which birds would not be there in the summer were it not for the contiguity of the suitable nesting area. Likewise the absence of suitable nesting sites in adjacent areas will in many cases cause the absence of certain species in a given area. The various lists of birds are intended to

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include all those that occur regularly in summer, *without regard to actual breeding within the area*; neither is any distinction made in the case of very local species, whose ranges do not completely fill the particular area under consideration. Furthermore, we have omitted from the lists all but summer birds, all that occur but accidentally, all extinct species, and all those of casual or very irregular occurrence. Species which are of very rare though regular occurrence are followed by (R). No other attempt is here made to indicate the strictly *characteristic* birds.

ECOLOGICAL ASSOCIATIONS OF BIRDS AND PLANTS IN TEXAS.

Gulf Shore Association.

This area consists of the beaches of the Gulf of Mexico and its bays, together with the sandy islands along the coast, and the tide-flats bordering the various lagoons and inlets. Its characteristics are great stretches of sand and mud-flats. The vegetation is mostly sparse, and is made up principally of low grasses and annuals with, in places, scattered bushes. The birds are mostly waterfowl and shore birds, many of which nest on the sand.

The list of plants follows:

Cenchrus carolinianus
Chaetochloa macrosperma
Eleusine indica
Eragrostis hypnoides
Leptochloa fascicularis
Monanthochloe littoralis
Panicum capillare
Paspalum distichum
Paspalum vaginatum
Sporobolus virginicus
Triplasis americana
Triplasis purpurea
Uniola paniculata
Cyperus tetragonus
Eleocharis torreyana
Psilocarya nitens
Sisyrinchium exile
Sisyrinchium helleri

Sida ciliaris
Sida helleri
Tamarix gallica
Opuntia engelmanni
Opuntia humifusa
Meriolix serrulata drummondii
Raimannia drummondii
Samolus alyssoides
Bumelia lanuginosa
Sabbatia calycina
Cressa traxillensis
Ipomoea dissecta
Ipomoea littoralis
Ipomoea pescaprae
Phlox drummondii
Phacelia laxa
Heliotropium curassavicum
Lycium carolinianum

Populus deltoides (R)
Salix nigra
Quercus breviloba
Dondia intermedia
Dondia linearis
Salicornia perennis
Batis maritima
Tissa marina
Cakile geniculata
Prosopis glandulosa
Vachellia farnesiana
Canavalia obtusifolia
Xanthoxylum fagara
Castela nicholsonii
Vitis candicans
Vitis caribaea
Gossypium religiosum

Physalis elliotii
Physalis viscosa
Solanum elaeagnifolium
Mecardonia viridis
Tubiflora acuminata
Cephalanthus occidentalis
Houstonia salina
Iva frutescens
Xanthium glabratum
Baccharis halimifolia
Borrichia frutescens
Cirsium borridulum
Erigeron myrionactis
Erigeron repens
Isocoma drummondii
Sideranthus phyllocephalus

The birds of this area are as follows:

Phalacrocorax vigua mexicanus
Anhinga anhinga
Fregata magnificens rothschildi
Pelecanus fuscus fuscus
Pelecanus erythrorhynchos
Nyctanassa violacea
Nycticorax nycticorax naevius
Butorides virescens virescens
Florida caerulea caerulea
Dichromanassa rufescens
Hydranassa tricolor ruficollis
Leucophoyx thula thula
Casmerodius alba egretta
Ardea herodias wardi
Mycteria americana
Guara alba
Plegadis guarauna
Ajaia ajaia
Aans fulvigula maculosa
Coragyps urubu urubu
Cathartes aura septentrionalis
Tachytriorchis albicaudatus sen-
netti (R)
Haliaeetus leucocephalus leuco-
cephalus
Accipiter cooperii (R)
Accipiter velox (R)
Circus cyaneus hudsonius (R)
Pandion haliaetus carolinensis (R)
Haematopus palliatus palliatus

Squatrola squatarola cynosurae
Oxyechus vociferus vociferus
Charadrius melodus (R)
Pagolla wilsonia wilsonia
Arenaria interpres morinella
Numenius americanus americanus
 (R)
Limnodromus griseus griseus
Limnodromus griseus scolopaceus
Totanus melanoleucus (R)
Catoptrophorus semipalmatus
semipalmatus
Himantopus mexicanus
Larus atricilla megalopterus
Gelochelidon nilotica aranea
Hydroprogne caspia imperator
Thalasseus maximus
Thalasseus sandwicensis acutiflatus
Sterna forsteri
Sterna hirundo (R)
Sternula albitrons antillarum
Sterna fuscata fuscata (R)
Rhyncops nigra
Streptoceryle alcyon alcyon
Otocoris alpestris giraudi
Corvus brachyhyrnchos paulus
Hirundo rustica erythrogastri
Stelgidopteryx serripennis serri-
pennis
Progne subis subis

Salt Marsh Association.

This is made up of the great salt marshes and salt meadows bordering the bays, inlets, lagoons, and river mouths of the coast, exclusive of the actual bare shore areas. Its most conspicuous vegetation consists of close-standing cat-tails (*Typha latifolia*), rushes, and sedges; or of closely matted marsh grasses. The birds are waterfowl and such land birds as are more or less dependent on the marsh vegetation for nesting or feeding grounds. Its plants are as follows:

<i>Typha latifolia</i>	<i>Dondia intermedia</i>
<i>Potamogeton pectinatus</i>	<i>Dondia linearis</i>
<i>Ruppia maritima</i>	<i>Salicornia bigelovii</i>
<i>Zostera marina</i>	<i>Salicornia perennis</i>
<i>Sagittaria lancifolia</i>	<i>Batis maritima</i>
<i>Vallisneria spiralis</i>	<i>Ranunculus pusillus</i>
<i>Distichlis spicata</i>	<i>Amorpha paniculata</i>
<i>Leptochloa fascicularis</i>	<i>Vigna repens</i>
<i>Leptochloa floribunda</i>	<i>Hibiscus moscheutos</i>
<i>Monanthochloe littoralis</i>	<i>Kosteletzkia althaeifolia</i>
<i>Spartina cynosuroides</i>	<i>Lythrum lineare</i>
<i>Spartina glabra</i>	<i>Isnardia natans</i>
<i>Spartina potens</i>	<i>Ptilimnium capillaceum</i>
<i>Zizania palustris</i>	<i>Limonium limbatum</i>
<i>Cladium effusum</i>	<i>Samolus ebracteatus</i>
<i>Cyperus pseudovegetus</i>	<i>Samolus floribundus</i>
<i>Cyperus speciosus</i>	<i>Eustoma russellianum</i>
<i>Eleocharis cellulosa</i>	<i>Scutellaria palustris</i>
<i>Eleocharis rostellata</i>	<i>Lycium carolinianum</i> (R)
<i>Fimbristylis castanea puberula</i>	<i>Agalinis fasciculata</i>
<i>Scirpus americanus</i>	<i>Agalinis maritima</i>
<i>Scirpus nanus</i>	<i>Baccharis angustifolia</i>
<i>Scirpus olneyi</i>	<i>Borrchia frutescens</i>
<i>Scirpus rubustus</i>	<i>Pluchea camphorata</i>
<i>Juncus roemerianus</i>	<i>Solidago angustifolia</i>
<i>Juncus setaceus</i>	<i>Solidago sempervirens</i>
<i>Sisyrinchium exile</i>	

The birds are:

<i>Colymbus dominicus brachypterus</i>	<i>Numenius americanus americanus</i>
<i>Phalacrocorax vigua mexicanus</i>	(R)
<i>Pelecanus fuscus fuscus</i>	<i>Limnodromus griseus griseus</i>
<i>Fregata magnificens rothschildi</i>	<i>Limnodromus griseus scolapaceus</i>
<i>Izobrychus exilis exilis</i> (R)	<i>Totanus melanoleucus</i>

- Botaurus lentiginosus* (R)
Nyctanassa violacea
Nycticorax nycticorax naevius
Butorides virescens virescens
Florida caerulea caerulea
Dichromanassa rufescens
Hydranassa tricolor ruf-ollis
Leucophox thula thula
Casmerodius alba egretta
Ardea herodias wardi
Mycteria americana
Guara alba
Plegadis guarauna
Ajaia ajaja
Querquedula discors (R)
Anas fulvigula maculosa
Dendrocygna bicolor
Dendrocygna autumnalis
Coragyps urubu urubu
Cathartes aura septentrionalis
Haliaeetus leucocephalus leucocephalus
Accipiter cooperii (R)
Accipiter velox (R)
Circus cyaneus hudsonius (R)
Pandion haliaetus carolinensis (R)
Fulica americana (R)
Gallinula chloropus cachinnans
Porphyryla martinica
Rallus longirostris saturatus
Squatarola squatarola cynosurae
Oxyechus vociferus vociferus
- Catoptrophorus semipalmatus semipalmatus*
Himantopus mexicanus
Larus atricilla megalopterus
Gelochelidon nilotica aranea
Hydroprogne caspia imperator (R)
Thalasseus maximus (R)
Thalasseus sandvicensis acutiflida (R)
Sterna forsteri
Sterna hirundo (R)
Sternula albifrons antillarum (R)
Streptoceryle alcyon alcyon
Tyrannus tyrannus tyrannus
Telmatodytes palustris thryophilus
Corvus brachynchos paulus
Hirundo rustica erythrogastris
Stelgidopteryx serripennis serripennis
Progne subis subis
Geothlypis trichas trichas
Agelaius phoeniceus phoeniceus (=floridanus)
Agelaius phoeniceus megapotaenus
Megaquiscalus major major
Megaquiscalus major macrourus
Quiscalus quiscula aeneus
Molothrus ater obscurus
Peucaea botteri botteri (R)
Thryospiza maritima fisheri
Thryospiza maritima sennetti

Coast Prairie Grass Association.

This covers the dry or moist open grassy areas of the prairies of the coast region, excluding their ponds, marshes, swamps, woods, and thickets. The characteristic vegetation is a floor of grasses, mixed with numerous herbaceous plants, mostly annuals, and in some places with an occasional isolated low bush or cactus. The characteristic birds are such as frequent open grassy land where they find such cover and nesting opportunities as the herbaceous vegetation affords.

Its principal plants are included in the following list:

- Ophioglossum crotalophoroides*
Ophioglossum vulgatum
- Tithymalus obtusatus*
Callirrhoe involucrata

<i>Agrostis hyemalis</i>	<i>Callirrhoe pedata</i>
<i>Alopecurus geniculatus</i>	<i>Spaeralcea lindheimeri</i>
<i>Andropogon glomeratus</i>	<i>Ascyrum hyperiocoides</i>
<i>Aristida intermedia</i>	<i>Ascyrum multicaule</i>
<i>Bouteloua barbata</i>	<i>Ascyrum stans</i>
<i>Chaetochloa geniculata</i>	<i>Opuntia engelmannii</i>
<i>Chaetochloa lutescens</i>	<i>Opuntia humifusa</i>
<i>Festuca octoflora</i>	<i>Gaura lindheimeri</i>
<i>Hordeum nodosum</i>	<i>Hartmannia speciosa</i>
<i>Panicum agrostoides</i>	<i>Hartmannia tetraptera</i>
<i>Panicum anceps</i>	<i>Kneiffia linifolia</i>
<i>Panicum dichotomiflorum</i>	<i>Kneiffia spathulata</i>
<i>Panicum geminatum</i>	<i>Merioliæ drummondiana</i>
<i>Panicum gymocarpon</i>	<i>Raimannia laciniata</i>
<i>Panicum hians</i>	<i>Cynosciadium pinnatum</i>
<i>Panicum reptans</i>	<i>Phellopterus macrorrhizus</i>
<i>Panicum scoparium</i>	<i>Centaurium calycosum</i>
<i>Panicum texanum</i>	<i>Centaurium texense</i>
<i>Paspalum floridanum</i>	<i>Eustoma russellianum</i>
<i>Paspalum pubiflorum</i>	<i>Sabbatis campestris</i>
<i>Phalaris caroliniana</i>	<i>Asclepias emoryi</i>
<i>Poa arachnifera</i>	<i>Asclepiodora decumbens</i>
<i>Sphenopholis obtusata</i>	<i>Convolvulus hermannioides</i>
<i>Sporobolus argutus</i>	<i>Evolvulus sericeus</i>
<i>Carex brittoniana</i>	<i>Phlox drummondii</i>
<i>Carex microdonta</i>	<i>Lantana camara</i>
<i>Carex triangularis</i>	<i>Verbena ciliata</i>
<i>Rhynchospora indianolensis</i>	<i>Verbena xutha</i>
<i>Comelina acrispa</i>	<i>Brazoria scutellarioides</i>
<i>Tradescantia gigantea</i>	<i>Monarda citriodora</i>
<i>Tradescantia micrantha</i>	<i>Scutellaria pilosa</i>
<i>Allium mutabile</i>	<i>Nicotiana trigonophylla</i>
<i>Nothoscordum striatum</i>	<i>Solanum elaeagnifolium</i>
<i>Yucca treculeana</i>	<i>Solanum triquetrum</i>
<i>Hypoxis hirsuta</i>	<i>Castilleja indivisa</i>
<i>Herbertia watsonii</i>	<i>Veronica peregrina</i>
<i>Nemastylis coelestina</i>	<i>Ruellia ciliosa</i>
<i>Sisyrinchium angustifolium</i>	<i>Plantago purshii</i>
<i>Ibidium reverchonii</i>	<i>Plantago virginica</i>
<i>Silene subciliata</i>	<i>Galearia trifidum</i>
<i>Delphinium carolinianum</i>	<i>Houstonia angustifolia</i>
<i>Ranunculus muricatus</i>	<i>Valerianella amarella</i>
<i>Ranunculus trachyspermus</i>	<i>Lobelia halei</i>
<i>Thalictrum texanum</i>	<i>Krigia virginica</i>
<i>Argemone platyceras</i>	<i>Pyrrhopappus carolinianus</i>
<i>Argemone rosea</i>	<i>Serinea oppositifolia</i>
<i>Lesquerella pallida</i>	<i>Aphanostephus skirrobasis</i>
<i>Morongia uncinata</i>	<i>Aster vernalis</i>

Chamaecrista procumbens
Krameria secundiflora
Astragalus distortus
Baptisia leucophaea
Baptisia spaerocarpa
Cracca lindheimeri
Galactia canescens
Galactia marginalis
Indigofera leptosepala
Lathyrus pusillus
Lupinus subcarneus
Medicago maculata
Psoralea rhombifolia
Trifolium carolinianum
Vicia ludoviciana
Zornia tetraphylla
Geranium carolinianum
Linum multicaule
Linum rigidum
Acalypha radians
Cnidioscolus stimulosus
Croton texensis
Stillingia sylvatica

Bellis integrifolia
Cirsium horridulum
Coreopsis coronata
Coreopsis nucensis
Coreopsis similis
Erigeron tenuis
Evax prolifera
Filago nivea
Gaillardia pulchella
Gnaphalium purpureum
Grindelia microcephala
Helenium microcephalum
Hymenopappus artemisiaefolius
Isopappus divaricatus
Mesadenia tuberosa
Ratibida columnifera
Rudbeckia hirta
Senecio ampullaceus
Senecio lobatus
Senecio vulgaris
Sideranthus aureus
Silphium scaberrimum
Verbesina encelioides

Here are found the following birds:

Ardea herodias wardi
Dendrocygna bicolor
Dendrocygna autumnalis
Coragyps urubu urubu
Carthartes aura septentrionalis
Rhynchofalco fuscocoerulescens septentrionalis
Polyborus cheriway auduboni
Buteo borealis borealis
Buteo swainsoni (R)
Tachytriorchis albicaudatus sennetti
Haliaeetus leucocephalus leucocephalus
Accipiter cooperii (R)
Accipiter velox (R)
Circus cyaneus hudsonius (R)
Elanus leucurus majusculus (R)
Elanoides forficatus forficatus (R)
Pandion haliaetus carolinensis (R)
Meleagris gallopavo silvestris (R)
Tympanuchus americanus attenuatus

Chaemepelia passerina pallescens (R)
Speotyto cunicularia hypugaea
Otus asio asio (=floridanus)
Otus asio meallii
Strix varia alleni
Strix varia helveola
Tyto alba pratincola
Nyctidromus albigollis merrilli
Chordeiles minor chapmani
Archilochus colubris
Chaetura pelagica
Tyrannus tyrannus tyrannus
Muscivora forficata
Otocoris alpestris giraudi
Mimus polyglottos polyglottos
Mimus polyglottos leucopterus
Sialia sialis sialis
Corvus brachyrhynchos paulus
Hirundo rustica erythrogastris
Stelgidopteryx serripennis serripennis
Progne subis subis

<i>Colinus virginianus virginianus</i>	<i>Geothlypis trichas trichas</i>
<i>Rallus longirostris saturatus</i>	<i>Sturnella magna argutula</i>
<i>Oxyechus vociferus vociferus</i>	<i>Sturnella magna hoopesi</i>
<i>Numenius americanus americanus</i>	<i>Agelaius phoeniceus phoeniceus</i>
(R)	(=floridanus)
<i>Catoptrophorus semipalmatus</i>	<i>Agelaius phoeniceus megapotaenus</i>
<i>semipalmatus</i>	<i>Megaquiscalus major major</i>
<i>Himantopus mexicanus</i>	<i>Megaquiscalus major macrourus</i>
<i>Larus atricilla megalopterus</i>	<i>Quiscalus quiscula aeneus</i>
<i>Gelochelidon nilotica aranea</i>	<i>Molothrus ater obscurus</i>
<i>Hydroprogne caspia imperator</i>	<i>Peucaea botteri botteri</i> (R)
(R)	<i>Thryospiza maritima fisheri</i>
<i>Thalasseus maximus</i> (R)	<i>Thryospiza maritima sennetti</i>
<i>Thalasseus sandvicensis acutis-</i>	<i>Ammodramus savannarum bima-</i>
<i>vida</i> (R)	<i>culatus</i>
<i>Sterna forsteri</i>	<i>Chondestes grammacus strigatus</i>
<i>Sterna hirundo</i> (R)	<i>Spiza americana</i>
<i>Sternula albifrons antillarum</i> (R)	<i>Passer domesticus domesticus</i>
<i>Zenaidura macroura marginella</i>	

Coast Prairie Thicket Association.

This includes the thickets on the coast prairies, both those along the streams and those on drier ground; also the scattered groves of trees and the thin fringes of timber along the streams. The dominant vegetation is therefore shrubby or arboreal. The characteristic birds are, as would be expected, bush- or tree-inhabiting species, for these find here abundant shelter and meeting sites as well as a plentiful food supply in the fruit of the bushes and trees and in the insects that such vegetation attracts. Only the northeastern part of the coast prairie is included in this association, since farther southwest it is in many places practically indistinguishable ecologically from the chaparral belt. The character of the vegetation of the Coast Prairie Thicket Association may be seen from the subjoined list of plants.

<i>Pinus echinata</i>	<i>Meibomia paniculata</i>
<i>Pinus palustris</i>	<i>Meibomia pauciflora</i>
<i>Pinus taeda</i>	<i>Meibomia sessiliflora</i>
<i>Elyonurus tripsacoides</i>	<i>Zanthoxylum clavaherulis</i>
<i>Panicum helleri</i>	<i>Zanthoxylum farago</i>
<i>Panicum polyanthes</i>	<i>Castela nicholsonii</i>
<i>Carex retroflexa</i>	<i>Polygala hookeri</i>
<i>Carex styloflexa</i>	<i>Polygala mariana</i>
<i>Carex texensis</i>	<i>Bernardia myricaeifolia</i>

- Cyperus hochstetteri*
Cyperus stenolepis
Dichromena latifolia
Eriocaulon texense
Xyris ambigua
Xyris baldwiniana
Tradescantia micrantha
Dendropogon usneoides
Tillandsia recurvata
Yucca treculeana
Smilax laurifolia
Smilax renifolia
Agave americana
Populus deltoides
Salix nigra
Cerothamnus cerifera
Hicoria glabra
Hicoria pecan
Quercus breviloba
Quercus marylandica
Quercus muhlenbergii
Quercus nigra
Quercus stellata
Quercus texana
Celtis mississippiensis
Momisia pallida
Ulmus americana
Ulmus crassifolia
Morus rubra
Toxylon pomiferum
Phoradendron flavescens
Viorna reticulata
Odostemon trifoliolatus
Persea borbonia
Platanus occidentalis
Rosa setigera
Rubus trivialis
Crataegus viridis
Acacia amentacea
Morongia uncinata
Prosopis glandulosa
Vachellia farnesiana
Parkinsonia aculeata
Krameria secundiflora
Amorpha fruticosa
Baptisia nuttalliana
Meibomia bracteosa
Phyllanthus carolinensis
Stillingia sylvatica
Tithymalus obtusatus
Rhus copallina
Toxicodendron radicans
Toxicodendron toxicodendron
Ilex cassine
Ilex decidua
Condalia obovata
Zizyphus obtusifolius
Acer negundo
Parthenocissus quinquefolia
Vitis candicans
Vitis cinerea
Tilia americana
Tamarix gallica
Opuntia englemanni
Opuntia humifusa
Opuntia leptocaulis
Cornus asperifolia
Batodendron arboreum
Brayodendron texanum
Diospyros virginiana
Bumelia lanuginosa
Phlox detonsa
Phlox tenuis
Lippia ligustrina
Dracocephalum virginianum
Capsicum baccatum
Lycium carolinianum
Solanum triquetrum
Buchnera elongata
Veronica serpyllifolia
Campsis radicans
Cephalanthus occidentalis
Galium trifidum
Sambucus canadensis
Symphoricarpos symphoricarpos
Viburnum molle
Iberivillea lindheimeri
Aster purpuratus
Borrchia frutescens
Chrysopsis nuttallii
Helenium fimbriatum
Helianthus ciliaris
Leucosyris spinosus
Ratibida picta

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The birds are as follows:

<i>Anhinga anhinga</i>	<i>Archilochus colubris</i>
<i>Nyctanassa violacea</i>	<i>Horizopus virens</i>
<i>Nycticorax nycticorax naevius</i>	<i>Empidonax virescens</i>
<i>Butorides virescens virescens</i> (R)	<i>Myiarchus crinitus crinitus</i>
<i>Florida caerulea caerulea</i> (R)	<i>Tyrannus tyrannus tyrannus</i>
<i>Leucophoyx thula thula</i>	<i>Muscivora forficata</i>
<i>Casmerodius alba egretta</i> (R)	<i>Mimus polyglottos polyglottos</i>
<i>Dendrocygna bicolor</i>	<i>Sialia sialis sialis</i>
<i>Coragyps urubu urubu</i>	<i>Poliopitila caerulea caerulea</i>
<i>Cathartes aura septentrionalis</i>	<i>Thryothorus ludovicianus ludovicianus</i>
<i>Buteo borealis borealis</i>	<i>Penthestes carolinensis carolinensis</i>
<i>Buteo lineatus alleni</i>	<i>Corvus brachyrhynchos paulus</i>
<i>Buteo platypterus platypterus</i> (R)	<i>Vireo bellii bellii</i>
<i>Haliaeetus leucocephalus leucocephalus</i>	<i>Vireo griseus griseus</i>
<i>Accipiter cooperii</i> (R)	<i>Lanius flavifrons</i>
<i>Accipiter velox</i> (R)	<i>Vireosylva olivacea</i>
<i>Ictinia mississippiensis</i>	<i>Icteria virens virens</i>
<i>Elanus leucurus majusculus</i> (R)	<i>Geothlypis trichas trichas</i>
<i>Elanoides forficatus forficatus</i> (R)	<i>Dendroica dominica albiflora</i>
<i>Pandion haliaetus carolinensis</i> (R)	<i>Dendroica aestiva aestiva</i> (R)
<i>Meleagris gallopavo silvestris</i> (R)	<i>Compsothlypis americana rama-</i>
<i>Colinus virginianus virginianus</i>	<i>lineae</i>
<i>Zenaidura macroura marginella</i>	<i>Mniotilta varia</i> (R)
<i>Coccyzus americanus americanus</i>	<i>Afelaius phoeniceus phoeniceus</i>
<i>Colaptes auratus auratus</i> (R)	<i>Icterus galbula</i> (R)
<i>Centurus carolinus</i>	<i>Icterus spurius</i>
<i>Melanerpes erythrocephalus erythrocephalus</i>	<i>Megaquiscalus major major</i>
<i>Phloeotomus pileatus pileatus</i>	<i>Quiscalus quiscula aeneus</i>
<i>Phrenopicus borealis</i>	<i>Molothrus ater obscurus</i>
<i>Dryobates pubescens pubescens</i>	<i>Piranga rubra rubra</i>
<i>Dryobates villosus auduboni</i>	<i>Richmondia cardinalis magnirostris</i>
<i>Bubo virginianus virginianus</i>	<i>Guiraca caerulea caerulea</i>
<i>Otus asio asio</i> (=floridanus)	<i>Passerina ciris ciris</i>
<i>Strix varia alleni</i>	<i>Spizella passerina passerina</i>
<i>Tyto alba pratincola</i>	<i>Chondestes grammacus strigatus</i>
<i>Antrostomus carolinensis</i>	<i>Spiza americana</i>
<i>Phalaenoptilus nuttallii nuttallii</i>	
<i>Chordeiles minor chapmani</i>	

Coast Prairie Aquatic Association.

This is made up chiefly of the coast prairie fresh water ponds and their margins, but includes also the actual water and the muddy grassy margins of the various streams

and ditches that intersect the prairie land, together with the extensive rice fields. Its characteristic vegetation consists of various rushes, sedges, grasses, and such plants as thrive in wet or very moist situations. The bird life reflects the character of this environment and comprises chiefly waterfowl, shore birds, and such species as prefer the combination of water and low herbaceous vegetation.

Plants that grow in this association are:

<i>Typha angustifolia</i>	<i>Eleocharis interstincta</i>
<i>Typha latifolia</i>	<i>Eleocharis macrostachya</i>
<i>Najas guadalupensis</i>	<i>Eleocharis mutata</i>
<i>Potamogeton angustifolius</i>	<i>Eleocharis obtusa</i>
<i>Potamogeton hybridus</i>	<i>Eleocharis rostellata</i>
<i>Potamogeton lucens</i>	<i>Eleocharis tenuis</i>
<i>Potamogeton pectinatus</i>	<i>Eleocharis torreyana</i>
<i>Ruppia maritima</i>	<i>Eleocharis tortilis</i>
<i>Alisma subcordatum</i>	<i>Eleocharis tuberculosa</i>
<i>Echinodorus cordifolius</i>	<i>Eleocharis vivipara</i>
<i>Echinodorus radicans</i>	<i>Fimbristylis autumnalis</i>
<i>Echinodorus tenellus</i>	<i>Fimbristylis castanea</i>
<i>Sagittaria graminea</i>	<i>Fimbristylis laxa</i>
<i>Sagittaria papillosa</i>	<i>Fimbristylis vahlII</i>
<i>Sagittaria platyphylla</i>	<i>Kyllinga brevifolia</i>
<i>Vallisneria spiralis</i>	<i>Kyllinga pumila</i>
<i>Limnium spongia</i>	<i>Psilocarya nitens</i>
<i>Chaetochloa geniculata</i>	<i>Rhynchospora oligantha</i>
<i>Chaetochloa magna</i>	<i>Scirpus carinatus</i>
<i>Echinochloa crusgalli</i>	<i>Scirpus eriophorum</i>
<i>Eragrostis glomerata</i>	<i>Scirpus hallii</i>
<i>Erianthus strictus</i>	<i>Scirpus lineatus</i>
<i>Homalocenchrus hexandrus</i>	<i>Seleria oligantha</i>
<i>Homalocenchrus oryzoides</i>	<i>Acorus calamus</i>
<i>Manisuris rugosa</i>	<i>Pistia stratiotes</i>
<i>Oryza sativa</i>	<i>Spirodela polyrrhiza</i>
<i>Panicularia nervata</i>	<i>Wolffiella floridana</i>
<i>Panicum gymnocarpon</i>	<i>Eriocaulon compressum</i>
<i>Panicum hians</i>	<i>Eriocaulon septangulare</i>
<i>Panicum scabriusculum</i>	<i>Xyris iridifolia</i>
<i>Paspalum conjugatum</i>	<i>Mayaca aubletii</i>
<i>Paspalum dissectum</i>	<i>Commelina hirtella</i>
<i>Tripsacum floridanum</i>	<i>Heteranthera dubia</i>
<i>Paspalum monostachyum</i>	<i>Heteranthera limosa</i>
<i>Paspalum praecox</i>	<i>Heteranthera reniformis</i>
<i>Paspalum repens</i>	<i>Pondetaria cordata</i>
<i>Phragmites phragmites</i>	<i>Juncus elliottii</i>
<i>Uiola latifolia</i>	<i>Juncus filipendulus</i>

Zizania palustris
Zizaniopsis miliacea
Carex frankii
Carex lupulina
Carex lurida
Carex microdonta
Cladium effusum
Cyperus articulatus
Cyperus cephalanthus
Cyperus erythrorhizos
Cyperus esculentus
Cyperus ferax
Cyperus haspan
Cyperus helvus
Cyperus iria
Cyperus pseudovegetus
Cyperus stenolepis
Cyperus strigosus
Dulichium arundinaceum
Eleocharis albida
Eleocharis arenicola
Eleocharis cellulosa
Eleocharis elongata
Eleocharis glaucescens

Its birds are:

Colymbus dominicus brachypterus
Phalacrocorax vigua mexicanus
Anhinga anhinga
Ixobrychus exilis exilis (R)
Botaurus lentiginosus (R)
Nyctanassa violacea
Nycticorax nycticorax naevius
Butorides virescens virescens
Florida caerulea caerulea
Hydranassa tricolor ruficollis
Leucophoyx thula thula
Casmerodius alba egretta
Ardea herodias wardi
Mycteria americana
Guara alba
Plegadis guarauna
Ajaia ajaja
Alix sponsa
Spatula clypeata (R)
Querquedula discors (R)
Anas fulvigula maculosa
Dendrocygna bicolor

Juncus repens
Juncus texanus
Thalia barbata
Crinum americanum
Hymenocallis galvestonensis
Sisyrinchium augustifolium
Brasenia purpurea W
Cabomba cavoliniana
Castalia ampla
Castalia elegans
Castalia mexicana
Nymphaea puberula
Ceratophyllum demersum
Ranunculus oblongifolius
Ranunculus pusillus
Daubentonia longifolia
Cynosciadium pinnatum
Forestiera acuminata
Limnanthemum aquaticum
Utricularia biflora
Utricularia inflata
Utricularia radiata
Utricularia vulgaris

Squatarola squatarola cynosuræ
Oxyechus vociferus vociferus
Numenius americanus americanus
(R)
Limnodromus griseus griseus
Limnodromus griseus scolopaceus
Totanus melanoleucus (R)
Catoptrophorus semipalmatus semipalmatus
Himantopus mexicanus
Larus atricilla megalopterus
Gelichelidon nilotica aranea
Hydroprogne caspia imperator
(R)
Thalasseus maximus (R)
Thalasseus sandvicensis acutifida
(R)
Sterna forsteri
Sterna hirundo (R)
Sternula albifrons antillarum
Zenaidura macroura marginella
Streptoceryle alcyon alcyon

<i>Dendrocygna autumnalis</i>	<i>Otus asio asio</i> (=floridanus) (R)
<i>Coragyps ururbu urubu</i>	<i>Otus asio mecallii</i> (R)
<i>Cathartes aura septentrionalis</i>	<i>Chordeiles Minor chapmani</i>
<i>Tachytriorchis albicaudatus sen-</i>	<i>Chaetura pelagica</i>
<i>netti</i>	<i>Tyrannus tyrannus tyrannus</i>
<i>Buteo swainsoni</i> (R)	<i>Muscivora forficata</i>
<i>Haliaeetus leucocephalus leu-</i>	<i>Corvus brachyrhynchos paulus</i>
<i>cocephalus</i>	<i>Hirundo rustica erythrogastris</i>
<i>Accipiter cooperii</i> (R)	<i>Stelgidopteryx serripennis serri-</i>
<i>Accipiter velox</i> (R)	<i>pennis</i>
<i>Circus cyaneus hudsonius</i> (R)	<i>Progne subis subis</i>
<i>Elanus leucurus majusculus</i> (R)	<i>Geothlypis trichas trichas</i>
<i>Elanoides forficatus forficatus</i> (R)	<i>Agelaius phoeniceus phoeniceus</i> -
<i>Pandion haliaetus carolinensis</i> (R)	(=floridanus)
<i>Fulica americana</i> (R)	<i>Agelaius phoeniceus megapotamus</i>
<i>Gallinula chloropus cachinnans</i>	<i>Megaquiscalus major major</i>
<i>Porphyrula martinica</i>	<i>Megaquiscalus major macrourus</i>
<i>Rallus elegans</i> (R)	<i>Quiscalus quiscula aeneus</i>
<i>Rallus longirostris saturatus</i>	<i>Molothrus ater obscurus</i>

Eastern Riparian Association.

This comprises the cypress and other fresh-water swamps, the bayous, the humid river valleys and bottomlands of the eastern third of the State. It is one of the best-marked ecologic division of Texas, and is noted for its heavy deciduous forest, with occasionally thick undergrowth or stretches of wet thickets; but with little or no open land, excepting the broad, sandy, flood-swept beds of some of the rivers. The dense thickets and heavy forests form an ideal retreat for such birds as require seclusion and abundance of shelter. Its most important birds are the forest and humid thicket species of the austroriparian division of the lower austral life zone of the Nearctic Region.

The characteristic plants are as follows:

<i>Polypodium polypodioides</i>	<i>Gleditsia triacanthos</i>
<i>Taxodium distichum</i>	<i>Cercis canadensis</i>
<i>Arundinaria macrosperma</i>	<i>Bradleya frutescens</i>
<i>Dendropogon usneoides</i>	<i>Zanthoxylum clavaherculis</i>
<i>Tradescantia virginica</i>	<i>Rhus copalina</i>
<i>Hymenocallis occidentalis</i>	<i>Rhus lanceolata</i>
<i>Smilax bonariæ</i>	<i>Toxicodendron radicans</i>
<i>Smilax cinnamomifolia</i>	<i>Ilex cassine</i>
<i>Smilax hispida</i>	<i>Ilex decidua</i>
<i>Smilax laurifolia</i>	<i>Ilex lucida</i>

(R)

Smilax rotundifolia
Leitneria floridana
Populus deltoides
Salix interior
Salix longipes
Salix nigra
Cerothamnus cerifera
Hicoria alba
Hicoria aquatica
Hicoria glabra
Hicoria ovata
Hicoria pecan
Juglans nigra
Alnus rugosa
Betula nigra
Carpinus caroliniana
Ostrya virginiana
Castanea pumila
Quercus alba
Quercus digitata
Quercus lyrata
Quercus macrocarpa
Quercus michauxii
Quercus nigra
Quercus phellos
Quercus texana
Quercus velutina
Quercus virginiana
Celtis mississippiensis
Planera aquatica
Ulmus alata
Ulmus americana
Ulmus fulva
Morus rubra
Toxylon pomiferum
Phoradendron flavescens
Viorna crispa
Magnolia foetida
Magnolia virginiana
Asimina triloba
Persea borbonia
Hamamelis virginiana
Liquidamber styraciflua
Platanus occidentalis
Rubus procumbens
Rubus trivialis
Crataegus aestivalis
Crataegus brachyacantha

Ilex opaca
Ilex vomitoria
Berchemia scandens
Rhamus caroliniana
Rhamus lanceolata
Acer drummondii
Acer negundo
Acer rubrum
Ampelopsis arborea
Ampelopsis cordata
Parthenocissus quinquefolia
Vitis cinerea canescens
Vitis cordifolia
Vitis rupestris
Vitis vulpina
Tilia americana
Tilia leptophylla
Passiflora incarnata
Jussiaea decurrens
Jussiaea leptocarpa
Jussiaea suffruticosa
Ludwigia glandulosa
Aralia spinosa
Cornus asperifolia
Cornus stricta
Cynoxylon floridum
Nyssa aquatica
Nyssa sylvatica
Azalea canescens
Diospyros virginiana
Mohrdendron carolinum
Mohrodendron dipterum
Styrax platanifolia
Styrax pulverulenta
Gelsemium sempervirens
Fraxinus americana
Fraxinus caroliniana
Callicarpa americana
Bignonia crucigera
Campsis radicans
Catalpa catalpa
Catalpa speciosa
Utricularia cornuta
Utricularia inflata
Utricularia juncea
Utricularia radiata
Cephalanthus occidentalis
Mitchella repens

Crataegus chapmanii
Crataegus marshallii
Crataegus spathulata
Crataegus viridis
Gleditsia aquatica

Its birds are:

Nyctanassa violacea
Nycticorax nycticorax naevius
Butorides virescens virescens
Florida caerulea caerulea
Hydranassa tricolor ruficollis
Leucophoyx thula thula
Casmerodius alba egretta
Ardea herodias wardi
Mycteria americana
Aix sponsa
Coragys urubu urubu
Cathartes aura septentrionalis
Cerchneis sparveria sparveria
Buteo borealis borealis (R)
Buteo lineatus alleni
Buteo platypterus platypterus
Haliaeetus leucocephalus leucocephalus (R)
Accipiter cooperii (R)
Accipiter velox (R)
Circus cyaneus hudsonius (R)
Ictinia mississippiensis
Elanoides forficatus forficatus (R)
Meleagris gallopavo silvestris
Colinus virginianus virginianus
Fulica americana (R)
Gallinula chloropus cachinnans (R)
Actitis macularia (R)
Rubicola minor (R)
Sternula albifrons antillarum
Zenaidura macroura marginella
Coccyzus americanus americanus
Colaptes auratus auratus
Centurus carolinus
Melanerpes erythrocephalus erythrocephalus
Phloeotomus pileatus pileatus
Phrenopicus borealis
Dryobates pubescens pubescens
Dryobates villosus auduboni

Viburnum molle
Viburnum nudum
Viburnum rufidulum
Iva angustifolia

Myarchus crinitus crinitus
Tyrannus tyrannus tyrannus
Mimus polyglottos polyglottos
Dumetella carolinensis (R)
Sialia sialis sialis
Hylocichla mustelina
Poliopitila caerulea caerulea
Thryothorus ludovicianus ludovicianus
Sitta pusilla
Sitta carolinensis carolinensis
 (=aikeni)
Baeolophus bicolor
Cyanocitta cristata cristata
 (=florincola)
Corvus brachyrhynchos paulus
Vireo bellii bellii
Vireo griseus griseus
Lanivireo flavifrons
Vireosylva olivacea
Stelgidopteryx serripennis serripennis
Progne subis subis
Setophaga ruticilla
Wilsonia citrina
Icteria virens virens
Geothlypis trichas trichas
Oporornis formosus
Seiurus motacilla (R)
Dendroica dominica albilora
Dendroica cerulea
Compsothlypis americana ramalinae
Protomotaria citrea
Helmitheros vermivorus
Limothlypis swainsonii
Mniotilta varia
Agelaius phoeniceus phoeniceus
 (=floridanus)
Agelaius phoeniceus predatorius
Icterus galbula (R)

Campephilus principalis
Streptoceryle alcyon alcyon
Bubo virginianus virginianus
Otus asio asio (= *floridanus*)
Strix varia alleni
Antrostomus carolinensis
Archilochus colubris
Chaetura pelagica
Horizopus virens
Empidonax virescens

Icterus spurius
Megaquiscalus major major
Quiscalus quiscalus aeneus
Molothrus ater ater
Piranga rubra rubra
Richmondia cardinalis magnirostris
Guiraca caerulea caerulea
Passerina ciris ciris
Passerina cyanea

Eastern Pine Association.

This is also a forest area, and consists of the practically pure stands of pine timber in the eastern third of the State. The dominant trees are *Pinus taeda*, *Pinus echinata*, and *Pinus palustris*; but in the more open parts of the forest and particularly along the small streams and dry stream beds there is in places a considerable admixture of deciduous trees and shrubs. Its avifauna is a combination of pine inhabiting and other forest species, entirely lacking shore birds and waterfowl. In few areas is the influence of the vegetation on the bird life more evident.

The principal plants are included in the following list:

Pteridium aquilinum
Pteridium caudatum
Pinus echinata
Pinus palustris
Pinus taeda
Anthraenanthia villosa
Elyonurus tripsacoides
Muhlenbergia capillaris
Muhlenbergia expansa
Panicum aciculare
Panicum angustifolium
Panicum arenicoloides
Panicum consanguineum
Tridens ambiguus
Dichromena colorata
Rhynchospora fuscoides
Rhynchospora grayi
Rhynchospora rariflora
Rhynchospora semiplumosa
Scleria ciliata
Scleria gracilis
Scleria trichopoda

Rhus copallina
Rhus glabra
Rhus lanceolata
Toxicodendron radicans
Toxicodendron toxicodendron
Celastrus scandens
Parthenocissus quinquefolia
Vitis cordifolia
Vitis palmata
Hypericum fasciculatum
Helianthemum carolinianum
Viola vittata
Centella repanda
Eryngium integrifolium
Eryngium prostratum
Eryngium synchaetum
Cornus asperifolia
Batodendron arboreum
Vaccinium elliotii
Diospyros virginiana
Fraxinus lanceolata
Amsonia ciliata

Eriocaulon texense
Xyris ambigua
Xyris baldwiniana
Aletris aurea
Smilax glauca
Smilax lanceolata
Hicoria alba
Hicoria ovata
Ostrya virginiana
Castanea pumila
Fagus grandifolia
Quercus alba
Quercus lyrata
Quercus marylandica
Quercus michauxii
Quercus stellata
Quercus texana
Celtis mississippiensis
Clematis drummondii
Magnolia virginiana
Sassafras sassafras
Liquidambar styraciflua
Rubus trivialis
Crataegus aestivalis
Prunus americana
Prunus hortulana
Prunus tarda
Cercis canadensis
Dolicholus minimus
Erythrina herbacea
Meibomia laevigata
Zanthoxylum clavaherculis
Polygala hookeri
Polygala mariana

The birds are:

Coragynus urubu urubu
Cathartes aura septentrionalis
Cerchneis sparveria sparveria
Buteo borealis borealis
Buteo lineatus alleni
Buteo platyterus platyterus (R)
Accipiter cooperii (R)
Ictinia mississippiensis
Meleagris gallopavo silvestris
Colinus virginianus virginianus
Zenaidura macroura marginella
Coccyzus americanus americanus

Acerates floridana
Breweria aquatica
Breweria pickeringii
Phlox detonsa
Afzelia cassioides
Agalinis setacea
Buchnera elongata
Pentstemon pubescens
Bignonia crucigera
Campsis radicans
Pinguicula pumila
Sambucus canadensis
Viburnum rufidulum
Lobelia appendiculata
Aster phyllolepis
Aster purpuratus
Chaptalia semifloscularis
Chondrophora nudata
Chondrophora virgata
Chrysopsis microcephala
Erigeron quercifolius
Eupatorium compositifolium
Eupatorium rotundifolium
Gaillardia lanceolata
Gnaphalium falcatum
Helenium finebriatum
Hymenopappus carolinensis
Oligoneuron nitidum
Rudbeckia alismaefolia
Rudbeckia bicolor
Solidago amplexicaulis
Solidago celtidifolia
Solidago wardi

Sialia sialis sialis
Poliophtila caerulea caerulea
Thryothorus ludovicianus ludovicianus
Sitta pusilla
Sitta carolinensis carolinensis
 (=aikenii)
Penthestes carolinensis carolinensis
Baeolophus bicolor
Cyanocitta cristata cristata
 (=florincola)

Colaptes auratus auratus
Centurus carolinus
Melanerpes erythrocephalus erythrocephalus
Phloeotomus pileatus pileatus
Phrenopicus borealis
Dryobates pubescens pubescens
Dryobates villosus villosus (R)
Dryobates villosus audubonii
Bubo virginianus virginianus
Otus asio asio (=floridanus)
Strix varia alleni
Antrostomus carolinensis
Chordeiles minor chapmani
Archilochus colubris
Chaetura pelagica
Horizopus virens
Myiarchus crinitus crinitus

Corvus brachyrhynchos brachyrhynchos
Corvus brachyrhynchos paulus
Vireo griseus griseus
Lanivireo flavifrons
Vireosylva olivacea
Setophaga ruticilla
Dendroica pinus pinus
Dendroica dominica albiflora
Mniotilta varia
Icterus spurius (R)
Piranga rubra rubra
Richmondia cardinalis magnirostris
Spizella passerina passerina
Peucaea aestivalis illinoensis
Astragalinus tristis tristis (R)

Eastern Oak Association.

This is the area of deciduous woodlands on the uplands in the eastern third of Texas. Portions of it are forest composed almost entirely of post-oak (*Quercus stellata*); others are rich woods of various deciduous trees and bushes, sometimes with an admixture of pine.

The most conspicuous plants are included in the subjoined list:

Usnea barbata
Pinus echinata
Pinus taeda
Bromus purgans
Eragrostis hirsuta
Festuca obtusa
Leptochloa dubia
Muhlenbergia capillaris
Muhlenbergia diffusa
Panicum barbulatum
Panicum commutatum
Panicum depauperatum
Panicum dichotomum
Panicum flexile
Panicum huachucae silvicola
Panicum lanuginosum
Panicum lindheimeri
Panicum linearifolium
Panicum malacophyllum

Crataegus chapmanii
Crataegus spathulata
Malus soulardi
Padus serotina
Prunus americana
Prunus hortulana
Prunus tarda
Gleditsia triacanthos
Gymnocladus dioica
Cercis canadensis
Meibomia dillenii
Meibomia grandiflora
Meibomia pauciflora
Meibomia viridiflora
Psoralea pedunculata
Xanthoxalis stricta
Zanthoxylum clavaherculis
Acalypha gracilens
Acalypha virginica

<i>Panicum oligosanthos</i>	<i>Phyllanthus carolinensis</i>
<i>Panicum ovale</i>	<i>Stillingia sylvatica</i>
<i>Panicum thurouii</i>	<i>Rhus copallina</i>
<i>Panicum villosissimum</i>	<i>Rhus glabra</i>
<i>Panicum virgatum</i>	<i>Schmaltzia trilobata</i>
<i>Panicum werneri</i>	<i>Toxicodendron radicans</i>
<i>Panicum xalapense</i>	<i>Ilex decidua</i>
<i>Poa autumnalis</i>	<i>Celastrus scandens</i>
<i>Sphenopholis pallens</i>	<i>Aesculus pavia</i>
<i>Carex digitalis</i>	<i>Ampelopsis cordata</i>
<i>Carex retroflexa</i>	<i>Parthenocissus quinquefolia</i>
<i>Carex styloflexa</i>	<i>Vitis cordifolia</i>
<i>Carex triceps</i>	<i>Vitis lincomii</i>
<i>Carex wildenovii</i>	<i>Vitis palmata</i>
<i>Cuthbertia graminea</i>	<i>Tilia americana</i>
<i>Tinantia anomala</i>	<i>Viola missouriensis</i>
<i>Juncoides bulbosum</i>	<i>Viola rafinesquii</i>
<i>Polygonatum commutatum</i>	<i>Viola walteri</i>
<i>Smilax cinnamomifolia</i>	<i>Chaerophyllum tainturieri</i>
<i>Smilax glauca</i>	<i>Dringa canadensis</i>
<i>Smilax pseudochina</i>	<i>Eryngium ludovicianum</i>
<i>Smilax rotundifolia</i>	<i>Sanicula canadensis</i>
<i>Sisyrinchium pruinatum</i>	<i>Cornus asperifolia</i>
<i>Sisyrinchium sagittiferum</i>	<i>Cymoxylon floridum</i>
<i>Achroanthos monophylla</i>	<i>Nyssa sylvatica</i>
<i>Blephariglottis ciliaris</i>	<i>Vaccinium elliotii</i>
<i>Corallorhiza wisteriana</i>	<i>Diospyros virginiana</i>
<i>Hexaletris aphylla</i>	<i>Mohrodendron carolinum</i>
<i>Ibidium vernale</i>	<i>Fraxinus americana</i>
<i>Cerothamnus cerifera</i>	<i>Spigelia marylandica</i>
<i>Hicoria alba</i>	<i>Obolaria virginica</i>
<i>Hicoria myristicaeformis</i>	<i>Apocynum androsaemifolium</i>
<i>Hicoria ovata</i>	<i>Phlox pilosa</i>
<i>Juglans nigra</i>	<i>Koellia albescent</i>
<i>Ostrya virginiana</i>	<i>Salvia lyrata</i>
<i>Castanea pumila</i>	<i>Scutellaria cardiophylla</i>
<i>Fagus grandifolia</i>	<i>Scutellaria integrifolia</i>
<i>Quercus alba</i>	<i>Scutellaria pilosa</i>
<i>Quercus brevifolia</i>	<i>Agalinis gattereri</i>
<i>Quercus digitata</i>	<i>Dasystoma gardiflora</i>
<i>Quercus durandi</i>	<i>Pedicularis canadensis</i>
<i>Quercus lyrata</i>	<i>Ruellia pedunculata</i>
<i>Quercus macrocarpa</i>	<i>Campsis radicans</i>
<i>Quercus marylandica</i>	<i>Plantago rugelii</i>
<i>Quercus muhlenbergii</i>	<i>Galium circaezans</i>
<i>Quercus phellos</i>	<i>Galium pilosum</i>
<i>Quercus prinoides</i>	<i>Galium triflorum</i>
<i>Quercus rubra</i>	<i>Galium uniflorum</i>

Quercus stellata
Quercus velutina
Celtis mississippiensis
Ulmus americana
Morus rubra
Toxylon pomiferum
Phoradendron flavescens
Tinaria cristata
Tovara virginiana
Chenopodium boscianum
Rivina humilis
Claytonia virginica
Silene stellata
Clematis drummondii
Isopyrum biternatum
Ranunculus fascicularis
Magnolia virginiana
Cebatha carolina
Podophyllum peltatum
Sassafras sassafras
Liquidambar styraciflua
Rosa engelmannii

Mitchella repens
Sambucus canadensis
Viburnum rufidulum
Viburnum ruficolum
Cyclanthera dissecta
Hieracium longipilum
Lactuca graminifolia
Chrysopsis nuttallii
Cirsium flaccidum
Cirsium muticum
Elephantopus carolinianus
Eupatorium compositifolium
Eupatorium incarnatum
Rudbeckia bicolor
Solidago amplexicaulis
Solidago bootii
Solidago caesia
Solidago celtidifolia
Solidago rugosa
Solidago ulmifolia
Solidago wardi
Verbesina helianthoides

The birds of this area are as follows:

Coragyps urubu urubu
Cathartes aura septentrionalis
Cerchneis sparveria sparveria
Polyborus cheriway auduboni
Buteo borealis borealis
Buteo lineatus alleni
Buteo platypterus platypterus (F)
Accipiter cooperii (R)
Accipiter velox (R)
Ictinia mississippiensis
Meleagris gallopavo silvestris
Colinus virginianus virginianus
Zenaidura macroura marginella
Geococcyx californianus (R)
Coccyzus americanus americanus
Colaptes auratus auratus
Melanerpes erythrocephalus erythrocephalus
Phloeotomus pileatus pileatus
Phrenopicus borealis
Dryobates pubescens pubescens
Dryobates villosus villosus (R)
Dryobates villosus audubonii
Bubo virginianus virginianus

Hylocichla mustelina
Poliophtila caerulea caerulea
Thryomanes bewickii cryptus
Thryothorus ludovicianus ludovicianus
Sitta pusilla
Sitta carolinensis carolinensis
 (=aikeni)
Penthestes carolinensis carolinensis
Baeolophus bicolor
Cyanocitta cristata cristata
 (=florincola)
Corvus brachyrhynchos brachyrhynchos
Corvus brachyrhynchos paulus
Vireo bellii bellii
Vireo griseus griseus
Lanius flavifrons
Vireosylva olivacea
Setophaga ruticilla
Icteria virens virens
Dendroica pinus pinus
Dendroica dominica albiflora

<i>Otus asio asio</i> (=floridanus)	<i>Compsothlypis americana ramalinae</i>
<i>Strix varia alleni</i>	<i>Mniotilta varia</i>
<i>Antrostomus carolinensis</i>	<i>Icterus spurius</i>
<i>Chordeiles minor chapmani</i>	<i>Piranga rubra rubra</i>
<i>Chordeiles minor howelli</i>	<i>Richmondia cardinalis magnirostris</i>
<i>Archilochus colubris</i>	<i>Passerina ciris ciris</i>
<i>Chaetura pelagica</i>	<i>Passerina ciris pallidior</i>
<i>Horizopus virens</i>	<i>Passerina cyanea</i>
<i>Empidonax traillii brewsteri</i> (R)	<i>Spizella pusilla pusilla</i>
<i>Empidonax minimus</i> (R)	<i>Peucaea aestivalis illinoensis</i>
<i>Myiarchus crinitus crinitus</i>	<i>Chondestes grammacus strigatus</i>
<i>Tyrannus tyrannus tyrannus</i>	<i>Astragalinus tristis tristis</i> (R)
<i>Mimus polyglottos polyglottos</i> (R)	
<i>Sialia sialis sialis</i>	

Eastern Brush Association.

The various kinds of brushy tracts and abandoned fields grown up to bushes and high weeds, on the uplands of the eastern third of the State, constitute this type of country. The brushy areas are clothed with a shrubby vegetation mixed with annuals and perennials, and more or less sparingly intermingled with trees that thrive in the open. The old fields are in most cases thickly covered with high herbaceous vegetation in places somewhat mixed with bushes and scattered trees. Conformably to the vegetation the bird-life shows an absence of strictly forest types, and comprises chiefly such species as are inhabitants of thickets or more open country.

The plants most conspicuous in this area are included in the list below:

<i>Aristida dichotoma</i>	<i>Geum vernum</i>
<i>Aristida lanosa</i>	<i>Rosa cherokeeensis</i>
<i>Bromus unioloides</i>	<i>Rubus procumbens</i>
<i>Capriola dactylon</i>	<i>Rubus trivialis</i>
<i>Cenchrus carolinianus</i>	<i>Crataegus chapmanii</i>
<i>Cenchrus echinatus</i>	<i>Crataegus marshallii</i>
<i>Chaetochloa gracilis</i>	<i>Crataegus spathulata</i>
<i>Chaetochloa italica</i>	<i>Malus soulandi</i>
<i>Echinochloa colonum</i>	<i>Prunus americana</i>
<i>Echinochloa crusgalli</i>	<i>Prunus hortulana</i>
<i>Eleusine indica</i>	<i>Prunus tarda</i>
<i>Eragrostis hirsuta</i>	<i>Morongia angustata</i>
<i>Eragrostis pilosa</i>	<i>Morongia uncinata</i>
<i>Festuca obtusa</i>	<i>Apios apios</i>

<i>Hordeum nodosum</i>	<i>Clitoria mariana</i>
<i>Hordeum pusillum</i>	<i>Falcata pitcheri</i>
<i>Muhlenbergia diffusa</i>	<i>Meibomia bracteosa</i>
<i>Panicum brachyanthum</i>	<i>Meibomia paniculata</i>
<i>Panicum capillare</i>	<i>Meibomia sessilifolia</i>
<i>Panicum commutatum</i>	<i>Vigna sinensis</i>
<i>Panicum dichotomiflorum</i>	<i>Xanthoxalis stricta</i>
<i>Panicum fasciculatum reticulatum</i>	<i>Zantoxylum clavaherculis</i>
<i>Panicum flexile</i>	<i>Acalypha gracilens</i>
<i>Panicum huachucae silvicola</i>	<i>Acalypha virginica</i>
<i>Panicum lindheimeri</i>	<i>Rhus copallina</i>
<i>Panicum sphaerocarpon</i>	<i>Rhus glabra</i>
<i>Panicum texanum</i>	<i>Rhus lanceolata</i>
<i>Panicum virgatum</i>	<i>Schmaltzia trilobata</i>
<i>Rytidix granularis</i>	<i>Toxicodendron radicans</i>
<i>Syntherisma sanguinalis</i>	<i>Toxicodendron toxicodendron</i>
<i>Syntherisma villosa</i>	<i>Ilex decidua</i>
<i>Carex digitalis</i>	<i>Celastrus scandens</i>
<i>Carex retroflexa</i>	<i>Cardiospermum halicacabum</i>
<i>Carex styloflexa</i>	<i>Cardiospermum microcarpum</i>
<i>Carex willdenovii</i>	<i>Parthenocissus quinquefolia</i>
<i>Scleria triglomerata</i>	<i>Vitis palmata</i>
<i>Juncoides bulbosum</i>	<i>Modiola caroliniana</i>
<i>Erythronium albidum</i>	<i>Viola walteri</i>
<i>Quamasis hyacinthina</i>	<i>Cornus asperifolia</i>
<i>Smilax bonanox</i>	<i>Cynoxylon floridum</i>
<i>Smilax cinnamomifolia</i>	<i>Diospyros virginiana</i>
<i>Smilax glauca</i>	<i>Obolaria virginica</i>
<i>Smilax pseudochina</i>	<i>Apocynum androsaemifolium</i>
<i>Smilax rotundifolia</i>	<i>Apocynum cannabinum</i>
<i>Dioscorea villosa</i>	<i>Asclepias variegata</i>
<i>Hypoxis hirsuta</i>	<i>Ipomoea purpurea</i>
<i>Cerothamnus cerifera</i>	<i>Blephilia hirsuta</i>
<i>Ostrya virginiana</i>	<i>Koellia flexuosa</i>
<i>Castanea pumila</i>	<i>Mentha rotundifolia</i>
<i>Quercus marylandica</i>	<i>Salvia lyrata</i>
<i>Urtica chamaedryoides</i>	<i>Scutellaria integrifolia</i>
<i>Morus alba</i>	<i>Scutellaria pilosa</i>
<i>Morus nigra</i>	<i>Trichostema dichotomum</i>
<i>Toxylon pomiferum</i>	<i>Datura stramonium</i>
<i>Rumex obtusifolius</i>	<i>Datura tatula</i>
<i>Tiniaria cristata</i>	<i>Physalis mollis</i>
<i>Tovara virginiana</i>	<i>Solanum nigrum</i>
<i>Chenopodium album</i>	<i>Azelia macrophylla</i>
<i>Chenopodium berlandieri</i>	<i>Pedicularis canadensis</i>
<i>Chenopodium boscianum</i>	<i>Veronica serpyllifolia</i>
<i>Chenopodium botrys</i>	<i>Campsis radicans</i>
<i>Amaranthus blitoides</i>	<i>Plantago rugelii</i>

Amaranthus graecizans
Amaranthus hybridus
Amaranthus retroflexus
Phytolacca americana
Rivina humilis
Mollugo verticillata
Portulaca oleracea
Arenaria lanuginosa
Silene antirrhina
Clematis drummondii
Viorna coccinea
Cebatha carolina
Sassafras sassafras
Coronopus coronopus
Coronopus didymus
Lepidium densiflorum
Lepidium virginicum
Liquidambar styraciflua

Galium circaeazans
Galium triflorum
Sambucus canadensis
Viburnum rufidulum
Cucumis anguria
Cyclanthera dissecta
Ibervillea tripartita
Melothria chlorocarpæ
Sicyos angulata
Aster phyllolepis
Aster purpuratus
Aster texanus
Cirsium altissimum
Cirsium muticum
Parthenium hysterophorus
Polymnia uvedalia
Rudbeckia triloba
Solidago caesia

The birds found here are:

Coragyps urubu urubu
Cathartes aura septentrionalis
Cerchneis sparveria sparveria
Polyborus cheriway auduboni (R)
Buteo borealis borealis
Buteo platypterus platypterus (R)
Accipiter cooperii (R)
Accipiter velox (R)
Ictinia mississippiensis (R)
Meleagris gallopavo silvestris (R)
Colinus virginianus virginianus
Zenaidura macoura marginella
Geococcyx californianus (R)
Coccyzus americanus americanus
Colaptes auratus auratus
Melanerpes erythrocephalus erythrocephalus
Dryobates pubescens pubescens
Bubo virginianus virginianus (R)
Otus asio asio (=floridanus) (R)
Antrostomus carolinensis
Chordeiles minor chapmani
Archilochus colubris
Chaetura pelagica
Horizopus virens
Empidonax traillii brewsteri (R)
Empidonax minimus (R)
Myarchus crinitus crinitus

Sitta carolinensis carolinensis
 (=aikeni)
Penthestes carolinensis carolinensis
Bacolophus bicolor
Cyanocitta cristata cristata
 (=florincola)
Corvus brachyrhynchos brachyrhynchos
Corvus brachyrhynchos paulus
Vireo bellii bellii
Vireo griseus griseus
Lanivireo flavifrons (R)
Hirundo rustica erythrogastris
Progne subis subis
Icteria virens virens
Geothlypis trichas trichas
Dendroica discolor (R)
Dendroica aestiva aestiva (R)
Icterus galbula (R)
Icterus spurius
Quiscalus quiscula aeneus
Molothrus ater ater
Piranga rubra rubra
Richmondia cardinalis magnirostris
Guiraca caerulea caerulea
Passerina ciris ciris

Tyrannus tyrannus tyrannus
Muscivora forficata (R)
Mimus polyglottos polyglottos
Dumetella carolinensis (R)
Sialia sialis sialis
Poliophtila caerulea caerulea
Thryomanes bewickii cryptus
Thryothorus ludovicianus ludovicianus

Passerina ciris pallidior
Passerina cyanea
Spizella pusilla pusilla
Spizella passerina passerina
Peucaea aestivalis illinoensis
Chondestes grammacus strigatus
Spiza americana
Passer domesticus domesticus
Astraglinus tristis tristis (R)

Eastern Clearing Association.

The small stretches of open country and the various clearings not under actual cultivation on the eastern Texas uplands constitute this type of country. It is usually free from brush, though it has occasional bushes, thickets, and trees, particularly along fencerows; and ordinarily a more or less grassy covering. In the more recent clearings there are dead trees still standing. Its avifauna is therefore a combination of thicket-loving species and those that live in the open.

Typical of its vegetation are the following:

Agrostis elliottiana
Andropogon scoparius
Andropogon ternatus
Andropogon virginicus
Aristida dichotoma
Aristida gracilis
Aristida intermedia
Aristida oligantha
Aristida purpurascens
Aristida purpurea
Axonopus compressus
Axonopus furcatus
Capriola dactylon
Cenchrus carolinianus
Cenchrus echinatus
Cenchrus incertus
Chaetochloa geniculata
Chaetochloa gracilis
Chaetochloa italica
Chloris verticillata
Echinochloa colonum
Echinochloa crusgalli
Eleusine indica
Eragrostis capillaris

Sorghastrum nutans
Sphenopholis filiformis
Sphenopholis interrupta
Sphenopholis obtusata pubescens
Sphenopholis pallens longiflora
Sporobolus asper
Sporobolus asperifolius
Sporobolus canovirens
Sporobolus cryptandrus
Sporobolus drummondii
Sporobolus gracilis
Syntherisma sanguinalis
Syntherisma villosa
Tridens flavus
Uniola laxa
Yucca tenuistyla
Smilax glauca
Smilax pseudochina
Smilax rotundifolia
Cerothamnus cerifera
Quercus marylandica
Quercus stellata
Quercus texana
Quercus velutina

<i>Eragrostis hirsuta</i>	<i>Ulmus americana</i>
<i>Eragrostis pectinacea</i>	<i>Morus rubra</i>
<i>Eragrostis pilosa</i>	<i>Toxylon pomiferum</i>
<i>Eragrostis secundiflora</i>	<i>Sassafras sassafras</i>
<i>Eragrostis trichodes</i>	<i>Lepidium densiflorum</i>
<i>Festuca octoflora</i>	<i>Lepidium medium</i>
<i>Festuca sciurea</i>	<i>Lepidium virginicum</i>
<i>Gymnopogon ambiguus</i>	<i>Rubus procumbens</i>
<i>Heteropogon melanocarpus</i>	<i>Rubus trivialis</i>
<i>Holcus halapensis furcatus</i>	<i>Crataegus chapmanii</i>
<i>Hordeum nodosum</i>	<i>Crataegus marshallii</i>
<i>Hordeum pusillum</i>	<i>Crataegus spathulata</i>
<i>Manisuris cylindrica</i>	<i>Malus soulandi</i>
<i>Panicum anceps</i>	<i>Padus serotina</i>
<i>Panicum brachyanthum</i>	<i>Prunus americana</i>
<i>Panicum capillare</i>	<i>Gleditsia triacanthos</i>
<i>Panicum dichotomiflorum</i>	<i>Morongia angustata</i>
<i>Panicum fasciculatum</i>	<i>Morongia uncinata</i>
<i>Panicum flexile</i>	<i>Daubentonia longifolia</i> (R)
<i>Panicum geminatum</i>	<i>Zanthoxylum clavaherculis</i>
<i>Panicum hians</i>	<i>Rhus copallina</i>
<i>Panicum huachucae silvicola</i>	<i>Rhus glabra</i>
<i>Panicum lindheimeri</i>	<i>Toxicodendron radicans</i>
<i>Panicum ovinum</i>	<i>Celastrus scandens</i>
<i>Panicum polyanthes</i>	<i>Parthenocissus quinquefolia</i>
<i>Panicum praececius</i>	<i>Pussiflora incarnata</i>
<i>Panicum reptans</i>	<i>Mamillaria missouriensis</i>
<i>Panicum sphaerocarpon</i>	<i>Opuntia humifusa</i>
<i>Panicum texanum</i>	<i>Opuntia macrorhiza</i>
<i>Panicum virgatum</i>	<i>Cornus asperifolia</i>
<i>Paspalum angustifolium</i>	<i>Cynoxylon floridum</i>
<i>Paspalum larranagai</i>	<i>Diospyros virginiana</i>
<i>Paspalum plicatulum</i>	<i>Convolvulus repens</i>
<i>Paspalum pubiflorum</i>	<i>Campsis radicans</i>
<i>Rytidiz granularis</i>	<i>Sambucus canadensis</i>
<i>Schedonnardus paniculatus</i>	

The birds to be found in this association are:

<i>Coragyps urubu urubu</i>	<i>Muscivora forficata</i> (R)
<i>Cathartes aura septentrionalis</i>	<i>Mimus polyglottos polyglottos</i>
<i>Cerchneis sparveria sparveria</i>	<i>Sialia sialis sialis</i>
<i>Polyborus cheriway auduboni</i>	<i>Cyanocitta cristata cristata</i>
<i>Buteo borealis borealis</i>	(= <i>florincola</i>)
<i>Buteo platypterus platypterus</i> (R)	<i>Corvus brachyrhynchos brachyrhynchos</i>
<i>Accipiter cooperii</i> (R)	<i>Corvus brachyrhynchos paulus</i>
<i>Accipiter velox</i> (R)	<i>Lanivireo flavifrons</i>
<i>Circus cyaneus hudsonius</i> (R)	<i>Vireosylva gilva gilva</i> (R)
<i>Ictinia mississippiensis</i>	

<i>Elanoides forficatus forficatus</i> (R)	<i>Hirundo rustica erythrogastris</i>
<i>Meleagris gallopavo silvestris</i> (R)	<i>Stelgidopteryx serripennis serripennis</i>
<i>Tympanuchus americanus attwateri</i>	<i>Progne subis subis</i>
<i>Colinus virginianus virginianus</i>	<i>Sturnella magna magna</i>
<i>Oxyechus vociferus vociferus</i>	<i>Sturnella magna argutula</i>
<i>Bartramia longicauda</i> (R)	<i>Icterus galbula</i> (R)
<i>Zenaidura macoura marginella</i>	<i>Icterus spurius</i>
<i>Coccyzus americanus americanus</i>	<i>Quiscalus quiscula aeneus</i>
<i>Colaptes auratus auratus</i>	<i>Molothrus ater ater</i>
<i>Centurus carolinus</i> (R)	<i>Piranga rubra rubra</i>
<i>Melanerpes erythrocephalus erythrocephalus</i>	<i>Guiraca caerulea caerulea</i>
<i>Dryobates pubescens pubescens</i>	<i>Passerina ciris ciris</i>
<i>Dryobates villosus audubonii</i>	<i>Passerine ciris pallidior</i>
<i>Otus asio asio</i> (=floridanus)	<i>Passerina cyanea</i>
<i>Tyto alba pratincola</i> (R)	<i>Spizella pusilla pusilla</i>
<i>Chordeiles minor chapmani</i>	<i>Spizella passerina passerina</i>
<i>Chordeiles minor howelli</i>	<i>Peucaea aestivalis illinoensis</i>
<i>Archilochus colubris</i>	<i>Ammodramus savannarum bimaculatus</i>
<i>Chaetura pelagica</i>	<i>Chondestes grammacus strigatus</i>
<i>Horizopus virens</i>	<i>Spiza americana</i>
<i>Tyrannus tyrannus tyrannus</i>	<i>Passer domesticus domesticus</i>
	<i>Astragalinus tristis tristis</i> (R)

Eastern Agrarian Association.

This comprises the grain and other cultivated fields, the cultivated meadows, the gardens, orchards, and dooryards of the eastern Texas uplands. In the fields and gardens the various farm crops are the predominant vegetation, but there are some bushes and trees, with herbaceous vegetation, about the fencerows and similar places. Grasses and annuals cover the meadows; various fruit trees fill the orchards; while shade trees and shrubs surround the houses and ornament the dooryards. This combination of vegetation proves exceedingly attractive to birds that live more or less in the open; though most of the distinctively thicket and forest species, together with of course practically all the water and shore birds, are absent.

The character of the vegetation is shown by the following list of plants:

<i>Pinus echinata</i>	<i>Quercus texana</i>
<i>Pinus palustris</i>	<i>Quercus relutina</i>
<i>Pinus taeda</i>	<i>Ulmus americana</i>

- | | |
|---|------------------------------------|
| <i>Juniperus virginiana</i> | <i>Ulmus crassifolia</i> |
| <i>Andropogon furcatus</i> | <i>Morus alba</i> |
| <i>Andropogon glomeratus</i> | <i>Morus nigra</i> |
| <i>Andropogon ternatus</i> | <i>Morus rubra</i> |
| <i>Andropogon virginicus</i> | <i>Toxylon pomiferum</i> |
| <i>Anthoxanthum odoratum</i> | <i>Chenopodium album</i> |
| <i>Bromus unioloides</i> | <i>Amaranthus retroflorus</i> |
| <i>Capriola dactylon</i> | <i>Mollugo verticillata</i> |
| <i>Cenchrus carolinianus</i> | <i>Magnolia foetida</i> |
| <i>Cenchrus echinatus</i> | <i>Sassafras sassafras</i> |
| <i>Cenchrus incertus</i> | <i>Lepidium densiflorum</i> |
| <i>Chaetochloa italica</i> | <i>Lepidium medium</i> |
| <i>Chaetochloa lutescens</i> | <i>Lepidium virginicum</i> |
| <i>Chaetochloa verticillata</i> | <i>Rubus procumbens</i> |
| <i>Chaetochloa viridis</i> | <i>Rubus trivialis</i> |
| <i>Dactyloctenium aegyptium</i> | <i>Crataegus chapmanii</i> |
| <i>Echinochloa colonum</i> | <i>Crataegus marshallii</i> |
| <i>Echinochloa crusgalli</i> | <i>Crataegus spathulata</i> |
| <i>Eleusine indica</i> | <i>Malus soulardi</i> |
| <i>Eragrostis hirsuta</i> | <i>Padus serotina</i> |
| <i>Eragrostis pilosa</i> | <i>Prunus americana</i> |
| <i>Heteropogon melanocarpus</i> | <i>Gleditsia triacanthos</i> |
| <i>Holcus halapensis</i> | <i>Morongia angustata</i> |
| <i>Hordeum nodosum</i> | <i>Morongia uncinata</i> |
| <i>Manisuris cylindrica</i> | <i>Cercis canadensis</i> |
| <i>Panicum agrostoides</i> | <i>Lathyrus pusillus</i> |
| <i>Panicum anceps</i> | <i>Medicago maculata</i> |
| <i>Panicum brachyanthum</i> | <i>Trifolium carolinianum</i> |
| <i>Panicum capillare</i> | <i>Trifolium dubium</i> |
| <i>Panicum dichotomiflorum</i> | <i>Trifolium pratense</i> |
| <i>Panicum fasciculatum reticulatum</i> | <i>Trifolium reflexum</i> |
| <i>Panicum flexile</i> | <i>Vicia lidoviciana</i> |
| <i>Panicum geminatum</i> | <i>Xanthovalis langloisii</i> |
| <i>Panicum reptans</i> | <i>Melia azedarach</i> |
| <i>Panicum sphaerocarpon</i> | <i>Croton texensis</i> |
| <i>Panicum texanum</i> | <i>Rhus copallina</i> |
| <i>Panicum virgatum</i> | <i>Rhus glabra</i> |
| <i>Paspalum angustifolium</i> | <i>Toxicodendron radicans</i> |
| <i>Paspalum geminum</i> | <i>Celastrus scandens</i> |
| <i>Paspalum larranagai</i> | <i>Acer rubrum</i> |
| <i>Paspalum plicatulum</i> | <i>Parthenicissus quinquefolia</i> |
| <i>Paspalum pubiflorum</i> | <i>Passiflora incarnata</i> |
| <i>Phleum pratense</i> | <i>Opuntia macrorhiza</i> |
| <i>Rytidix granularis</i> | <i>Raimannia laciniata</i> |
| <i>Sorghastrum nutans</i> | <i>Cynoxylon floridum</i> |
| <i>Sphenopholis interrupta</i> | <i>Diospyros virginiana</i> |
| <i>Syntherisma sanguinalis</i> | <i>Convolvulus repens</i> |

(Continued in next issue.)

